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Venous Pressure and Vital Capacity

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METHODS for estimating the normal vital capacity without actual measurement have been varied. Shepard and Myers, and West and Dreyer compared vital capacity to size of body and succeeded in determining normal values. West believed that the value obtained by measurement of the surface of the body was the best for determining the normal vital capacity. Dreyer showed the relationship between the vital capacity, body weight and circumference of the thorax. Similar measurements were made by Rowe. Kharina compared age, weight, size, circumference of thorax, sitting height, and vital capacity, and found that the cube of the sitting height possessed a relationship to the vital capacity which could be expressed by the number 21. With the help of this calculation, he studied numerous cases in order to determine the influence of age, sex, and race. McCloy determined the vital capacity of 4,000 students and found that the deviation from normal was not in excess of 8.8 per cent. Nanagas and Santiago showed that the average value for the vital capacity is practically constant in different races. The relationship of volume of the thorax and vital capacity was studied by Billard and Gourdon. They found the following proportions of volume of thorax to vital capacity:

Volume of thorax:

5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0

Vital capacity:

0.9 1.0 1.4 1.5 1.9 12.0 2.3 2.65 2.65

Rabinowitch studied vital capacity and basal metabolism and found that when the vital capacity increased, the basal metabolism fell.

Wachholder used the vital capacity as a standard to determine the fitness of persons for athletic undertakings. The value was determined during rest and again after running from 150 to 200 meters. He found the following groups: (1) Good athletes; the vital capacity fell from 150 to 200 c.c. after the race and returned to the previous value in from two to three minutes. (2) Athletes with poor reserve; the vital capacity fell from 200 to 500 c.c. and returned to the original value in approximately three minutes. (3) In persons with labile circulatory systems and in constitutionally weak individuals, the vital capacity was reduced 500 c.c. or more and returned to the previous value only after five or more minutes.

The vital capacity has been determined in various diseases and occa-

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sionally has been used as a diagnostic and prognostic aid. Okado found normal values in patients with beri-beri. Myers and Rice found diminished values in cases of pleuritic adhesions, pulmonary tuberculosis and after healing had taken place in empyema. In pneumonia, Dreyer and Burrell demonstrated increase of the vital capacity with improvement, and decrease with increasing severity. According to Arnett and Kornblum, the vital capacity falls off sharply from the second to the fourth day after the crisis of pneumonia, and, in cases with normal convalescence, reaches approximately 70 per cent of the normal value thirty-five days after the crisis. Relapse in the course of pneumonia manifests itself relatively early by diminution of the vital capacity. Leas determined the values during the breathing of moist and dry air and found that the vital capacity of patients with bronchial asthma and bronchitis increased 25 per cent during the breathing of dry air. Patients with bronchial spasm, pulmonary edema, and diminished pulmonary expansion due to congestion from cardiac disease disclosed no change in the vital capacity when the patient was breathing moist or dry air. Peabody investigated the vital capacity systematically in patients with circulatory disease, and, with Sturgis, found it to be diminished. This decrease was thought not to be due to weakness of the muscles of respiration, as he found normal values in very weak patients with pernicious anemia. He found continually normal values, during repeated determinations, under conditions which presupposed tiring and weakness of the respiratory muscles. Peabody recommended the determination of vital capacity as a method for ascertaining the circulatory efficiency. He differentiated the following groups: patients with circulatory disease but with normal body performance and normal vital capacities; patients who are able to do light work and have vital capacities between 70 and 90 per cent of the normal; patients who are unable to work and have vital capacities between 50 and 70 per cent of the normal. Blumgart and Weiss studied various factors of the circulation; such as circulation time, arterial pressure, and venous pressure and brought these into relationship with the vital capacity. Frequently they found diminished vital capacity associated with slowing of the pulmonary circulation. Arnett and Kornblum studied vital capacity in cases of various kinds of valvular heart disease, and showed it to be less dependent on pathologic change than on the functional status of the heart. Engelhard believed that the carbon dioxide should be used in the determination of the vital capacity. Lundsgaard attempted to determine the cause of the diminution of the vital capacity in patients with cardiac disease. He found, in such patients, a change in the relationship of vital capacity, tidal air, residual air and complementary air. Diminution in the vital capacity could occur as a result of decrease of the total capacity as well as of increase in the amount of the residual air.

As determination of the vital capacity is very simple with a common

spirometer, we have made daily studies on a large number of patients with different diseases. We have found a regular diminution of the vital capacity in patients with circulatory insufficiency. The relationship is, however, not between anatomic cardiac changes and the vital capacity but between the functional status of the circulation and the vital capacity. We have demonstrated, also, a close relationship between the venous pressure and the vital capacity.

Patients with circulatory insufficiency and high venous pressure have definitely decreased values for vital capacity. If the condition of the patient is improved, then the venous pressure falls and the vital capacity increases (table 1). Both the vital capacity and the venous pressure were studied on the admission of a large number of patients to the hospital, and after eight days of intensive therapy. The results of the therapy are definitely recognizable. The increase of the venous pressure and the decrease of the vital capacity do not stand in linear relationship one with the other. Patients who come into the clinic in a badly decompensated state, and are successfully treated, seldom acquire more than 70 per cent of the expected normal vital capacity even after ten weeks of intensive treatment, and at a time when the venous pressure has long been at a normal level.

Sudden sinking of the venous pressure can be produced by the withdrawal of venous blood (table 2). The vital capacity shows no immediate great change but there is a definite tendency toward an increase, a fact in keeping with the patients' statements that they breathe more easily. Venesection has no definite effect on the pulse rate and the arterial pressure.

Many of our patients had pulmonary as well as circulatory disease. If pulmonary disease alone were present, the venous pressure was normal whereas the vital capacity was diminished (table 3). If cardiac insufficiency occurred in the course of pulmonary disease, there was increased venous pressure as well as diminished vital capacity.

The close relationship between breathing and circulation, in mechanical and physiochemical respects, allows many speculations concerning the changed vital capacity in cases of circulatory insufficiency. Such a change cannot be due to increased carbon dioxide tension of the blood, for such an increase will not diminish the vital capacity if the circulatory efficiency is normal. Nervous (Breuer-Heringscher reflex) or mechanical influences must be considered to explain altered vital capacity in cases of circulatory disease. In addition to the explanations already offered by other authors, we have considered over-filling of the lungs with blood, thus producing a mechanical effect on the vital capacity. There is also loss of elasticity of the lung, which is followed by an increase of the residual air.

Summary

The venous pressure is increased and the vital capacity decreased in patients with cardiac insufficiency due to any cause. Improvement of the circulatory status is attended by sinking of the venous pressure and increase

TABLE I

ILLUSTRATIVE CASES SHOWING THE EFFECT OF TREATMENT ON THE VITAL CAPACITY AND VENOUS PRESSURE IN CASES OF CIRCULATORY INSUFFICIENCY

			On Admission to the Hospital						After Eight Days of Treatment					
Case	Diagnosis	Age	Clinical Symptoms	Pulse Rate	Resp. Rate	Blood Pressure Arterial	Blood Pressure Venous	Vital Capacity (liters)	Clinical Symptoms	Pulse Rate	Resp. Rate	Blood Pressure Venous	Blood Pressure Arterial	Vital Capacity
1	Myocardial degeneration, lung edema, auricular fibrillation	65	Cyanosis, dyspnea, marked edema, enlarged liver, bloody sputum	92	32	165/20	30.0	1.0	Diminished cyanosis and dyspnea, liver size and edema markedly diminished, no blood in sputum	80	20	20.0	190/140	1.2
2	Hypertension, cardiac asthma, Ecg: arborization block, T waves in leads 1 and 2 inverted	53	Attacks of dyspnea, enlarged liver	98	24	200/30	13.0	1.1	Attacks of dyspnea have disappeared, liver not palpable	100	20	9.3	220/135	2.0
3	Aortic insufficiency, and stenosis, tabes dorsalis	59	Dyspnea with exertion, cyanosis	88	18	150/40	12.2	1.2	No cardiac symptoms	68	20	5.8	210/60	2.9
4	Hypertension, myocardial decompensation, auricular flutter	49	Edema, ascites, and dyspnea	64	30	145/50	15.0	1.3	Edema and dyspnea, no ascites	80	24	27.8	190/110	1.1

5	Myocardial degeneration, emphysema, bronchitis, lung infarct	64	Edema, dyspnea, cyanosis, enlarged liver	108	24	115/90	12.2	1.2	Edema, cyanosis, dyspnea	104	24	13.3	120/90	1.2
6	Mitral insufficiency, luetic aortitis, Ecg: arborization block	56	Cardiac oppression, dyspnea, liver swelling	70	18	145/75	13.6	2.7	Dyspnea and cardiac oppression absent. Liver still enlarged	96	20	9.5	150/70	2.9
7	Mitral insufficiency. Question of coronary thrombosis. Ecg: inverted T waves in leads 1 and 2, arborization block	66	Sudden attack of dyspnea and feeling of anxiety, edema	65	14	150/100	12.5	1.8	Edema diminished, dyspnea and feeling of anxiety absent at rest	60	16	2.8	175/95	2.5
8	Coronary sclerosis with angina pectoris emphysema, auricular flutter	75	Dyspnea, edema, attacks of pain and oppression in the region of the heart	80	24	145/90	17.8	0.5	Moderate exercise edema, sense of pressure in the region of the heart	88	20	5.8	160/100	0.9
9	Mitral insufficiency, auricular flutter	39	Cardiac palpitation, dyspnea and liver swelling	108	22	105/75	17.0	1.4	No palpitation, dyspnea with exertion, liver size, unchanged	92	24	18.2	115/85	1.7
10	Cardiac asthma, auricular flutter	54	Attacks of breathlessness and chest oppression	84	20	160/105			Absence of symptoms while at rest	96	18	6.0	150/90	2.0

TABLE 2

THE EFFECT OF VENESECTION ON THE VITAL CAPACITY AND THE VENOUS PRESSURE

	Before Venesection				After Venesection (300 c.c.)			
Case	Pulse Rate	Arterial Pressure	Venous Pressure	Vital Capacity	Pulse Rate	Arterial Pressure	Venous Pressure	Vital Capacity
1	96	140/100	26.0	0.9	98	135/95	21.8	1.1
2	92	125/75	20.0	1.0	88	120/80	14.0	1.3
3	120	185/100	19.8	0.9	120	145/95	17.2	1.2

TABLE 3

ILLUSTRATIVE CASES SHOWING THE EFFECT OF UNCOMPLICATED PULMONARY DISEASES UPON THE VITAL CAPACITY. THE VENOUS PRESSURES ARE NORMAL

Case	Diagnosis	Age	Weight in Pounds	Height in Inches	Venous Pressure	Vital Capacity
1	Pneumonia	28	130	66	5.0	1.1
2	Pulmonary tuberculosis	40	132	67	8.0	2.0
3	Emphysema	49	154	67	4.0	1.2

of the vital capacity. Patients with pulmonary disease and normal cardiac function have only a decreased vital capacity, but if circulatory failure occurs in the course of pulmonary disease, the venous pressure is increased.

BIBLIOGRAPHY

[1]ARNETT, J. H. and KORNBLUM, K.: Vital capacity; an inquiry into its value as a diagnostic procedure. Ann. Clin. Med., 1924-1925, iii, 255-274.

[2]BILLARD, G. and GOURDON, P.: Sur l'indice de la puissance de ventilation pulmonaire chez les enfants de l'école primaire. Compt. rend. Soc. de biol., 1926, xciv, 12-13.

[3]BLUMGART, H. L. and WEISS, SOMA: Clinical studies on the velocity of blood flow. IX. The pulmonary circulation time, the velocity of venous blood flow to the heart, and related aspects of the circulation in patients with cardiovascular disease. Jour. Clin. Investigation, 1927-1928, v, 343-392.

[4]DREYER, GEORGES and BURRELL, L. S. T.: The vital capacity constants applied to the study of pulmonary tuberculosis. The importance of these constants as a guide to classification and as a means of ascertaining the results of treatment. Lancet, 1920, cxcviii, 1212-1216.

[5]ENGLEHARD, ARNOLD: Der Wert der Spirometrie für die Klinik der Herzkrankheiten mit Lungenstauung und ihr Ausbau zu einer Funktionsprüfung. Deutsch. Arch. f. klin. Med., 1927, clvi, 1-65.

[6]KHARINA-MARINUCI, R.: Sull' indice di

sufficienza respiratoria volumetrica. Boll. d. Sc. di biol. sperine., 1926, i, 184-186.

[7]Leas, R. D.: Vital capacity; a study of the effect of breathing dry air. Arch. Int. Med., 1927, xxxix, 475-487.

[8]Lundsgaard, Christen: Determination and interpretation of changes in lung volumes in certain heart lesions: Jour. Am. Med. Assn., 1923, lxxx, 163-167.

[9]McCloy, C. H.: Vital capacity of Chinese students. Arch. Int. Med., 1927, xl, 686-700.

[10]Myers and Rice: The respiratory organs in health and disease; vital capacity of lungs in chronic fibrous pleurisy, healed empyema and pulmonary tuberculosis both clinical and nonclinical. Arch. Int. Med., 1925, xxxv, 557-560.

[11]Nanagas, J. C. and Santiago, L. C.: Vital capacity and physical standards of students of the University of the Philippines, Philippine Jour. Sc., 1927, xxxii, 325-359.

[12]Okado, Serzaburo: Trans. of the 6 Congr. of the Far Eastern Assn. of Trop. Med. Tokyo, 1925, i, 149-151.

[13]Peabody, F. W.: The vital capacity of the lungs in heart disease. Med. Clin. N. Amer., 1920-1921, iv, 1655-1671.

[14]Peabody, F. W. and Sturgis, C. C.: Clinical studies of the respiration. VII. The effect of general weakness and fatigue on the vital capacity of the lungs. Arch. Int. Med., 1921, xxviii, 501-510.

[15]Rabinowitch, I. M.: The vital capacity in hyperthyroidism with a study of the influence of posture. Arch. Int. Med., 1923, xxxi, 910-915.

[16]Rowe, A. W.: Vital function studies. I. An analysis of the Dreyer standards of vital capacity. Am. Jour. Physiol., 1925, lxxii, 436-445.

[17]Shepard, W. P. and Myers, J. A.: The respiratory organs in health and disease. XVI. A comparison of vital capacity standards in three thousand five hundred thirty-four male university students. Arch. Int. Med., 1925, xxxv, 337-346.

[18]Wachholder, Kurt: Die Vitalkapazität als Mass der Körperlichen Leistungsfähigkeit. Klin. Wchnschr., 1928, vii, 295-297.

[19]West, H. F.: Clinical studies on the respiration. VI. A comparison of various standards for the normal vital capacity of the lungs. Arch. Int. Med., 1920, xxv, 306-316.

Duodenitis, Duodenal Ulcer and Gastric Ulcer:

Experimental Lesions Produced with Streptococci Obtained from Surgically Resected Ulcer-bearing Tissue and from Other Foci of Infection*

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A causative organism of peptic ulcer was searched for in surgically resected tissue as well as in the various foci of infection and in the experimental lesions. In making cultures from the tissue, the tissue was crushed, finely macerated in a sterile mortar, with sterile sand, and then inoculated into various culture mediums. Control cultures also were made from pieces of apparently normal stomach and normal duodenal mucosa. Cultures from tonsils, extracted teeth and infected prostate glands were made. These cultural methods have been described in detail in previous publications. The cultures were then injected intravenously into rabbits in an attempt to determine their virulence and their affinity for the stomach and duodenum. In most cases two rabbits were used for each strain. In a few cases one or three rabbits were used, because of the scarcity or abundance of the supply of rabbits at the time. All the rabbits used were taken from a common stock shipped in from various neighboring states. They were maintained on a balanced diet, and housed comfortably, and intravenous injections were given which were calculated not to exceed 1 c.c. for each 200 gm. of body weight. Usually the dose was approximately 1 c.c. for each 300 gm.

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Results

Duodenitis.—The literature concerning duodenitis without associated ulceration is meager. Hemmeter, in 1897, in a consideration of chronic gastritis, included the description of a condition identical with that which now is called duodenitis. Roeder inferred that duodenitis is relatively common. Boas and Puhl reported duodenitis associated with gastritis. Judd described a condition which he called duodenitis and which he distinguished from the usual type of ulcer by the absence of a demonstrable crater. MacCarty and Wellbrock have described the pathologic changes that take place.

Cultures were obtained from twenty-one patients who had duodenitis without ulceration, as revealed by operation. Eighteen of these twenty-one patients had one or more foci of infection which contained a streptococ-

cus with selective affinity for the stomach or duodenum. In seventeen of thirty rabbits (57 per cent) which received injections of cultures obtained from teeth of patients, hemorrhagic lesions developed in the duodenum. Lesions of the stomach or duodenum developed also in 49 per cent of the rabbits that were given injections of cultures obtained from the tonsils, and in 28 per cent of those that received injection of cultures obtained from the prostate gland. In 53 per cent of the rabbits that were given injections of cultures obtained from surgically resected, inflamed duodenums, lesions of the stomach or duodenum developed (table 1). Altogether eighty-nine rabbits were given injections, in 51 per cent of which lesions developed either in the stomach or duodenum, or both. In contrast, only one animal of the eighty-nine had a lesion of the bowel other than the duodenum, one had a lesion of the muscles and one of the liver; two animals had lesions of the kidney, three of the appendix, and six of the joints.

Duodenal ulcer.—In a similar manner the experimental results obtained with cultures from patients with duodenal ulcer, with or without associated duodenitis, were analyzed (table 2). Ninety-three of 134 patients with duodenal ulcer had a focus of infection

TABLE 1

LOCALIZATION IN RABBITS OF STREPTOCOCCI OBTAINED FROM CASES OF DUODENITIS WITHOUT ULCERATION

		Number of rabbits having lesions of the:											
Source of culture	Rabbits injected	Stomach	Duodenum	Stomach and duodenum	Stomach, duodenum or both, per cent	Bowel	Appendix	Joint	Muscle	Lung	Liver	Kidney
Teeth	30	7	9	1	57		1	3			1	1
Tonsils	35	7	7	3	49	1	1		1	3		1
Prostate gland	7		1	1	28		1	1		1		
Duodenum	17	8		1	53			1				
Total	89	22	17	6		1	3	5	1	4	1	2
Total per cent					51	1	3	6	1	4	1	2

TABLE 2

LOCALIZATION IN RABBITS OF STREPTOCOCCI OBTAINED FROM CASES OF DUODENAL ULCER

		Number of rabbits having lesions of the:																
Source of culture	Rabbits injected	Stomach	Duodenum	Stomach and duodenum	Stomach, duodenum or both, per cent	Bowel	Appendix	Joint	Muscle	Nerve	Skin	Eye	Lung	Gallbladder	Liver	Kidney	Heart	Spleen
Teeth	166	49	24	13	52	3	2	14	3			2	10	4	2	3	4	
Tonsils	244	55	20	49	51	1	9	10	1	1	1	3	10	5	4	14	9	
Prostate gland	219	63	25	22	50	11	9	15	2	1		1	7	5	3	17	5	1
Duodenal ulcer	40	19	11	3	72	2	1	1		1				2	1	1	1	
Total	675	186	80	87		17	24	40	6	3	1	6	27	16	10	35	19	1
Total per cent					52	3	4	6	1	1	1	1	4	2	1	5	3	1

containing streptococci with affinity for the stomach or duodenum. In 52 per cent of the 675 rabbits that received injections of cultures from the teeth, in 51 per cent of those that received injections of cultures from the tonsils, in 50 per cent of those that received injections of cultures from the prostate gland, and in 72 per cent of those that were given injections of material from surgically resected ulcers, lesions developed that resembled those in the patients from whom the injected material was obtained. In some of these cases, lesions were found in both stomach and duodenum; 52 per cent had lesions either of the stomach or the duodenum, or both. Only a comparatively small number of the animals that were given injections had demonstrable lesions elsewhere in the body, the highest number of which was in the joints.

Gastric ulcer.—The results obtained with cultures from patients who had gastric ulcer were analyzed (table 3). Twenty-four of thirty-one patients with gastric ulcer had a focus of infection containing a streptococcus with affinity for the stomach or duodenum. As in the patients with duodenitis and duodenal ulcer, cultures from the teeth, tonsils, prostate gland, and resected ulcers each produced lesions in the stomach or duodenum of rabbits in a high percentage of cases. Ninety-six rabbits were given injections. In 64 per cent of the ninety-six rabbits, lesions either of the stomach or duodenum, or both, developed. The highest incidence of lesions elsewhere in the body was in the joints.

Controls.—In table 4 is shown collectively the three groups represented in tables 1, 2 and 3, together with a control group. One hundred thirty-five of 186 patients with peptic ulcer had a focus of infection harboring streptococci with affinity for the stomach or duodenum. A total of 860 rabbits were given injections of these 186 strains, and in 52 per cent of them lesions developed either in the stomach or duodenum, or both. The highest incidence of lesions elsewhere in the body was in the joints; arthritis developed in 6 per cent of the rabbits.

In the bottom row of table 4 are data on the control group which contains the results obtained with strains of streptococci isolated from patients who had no definite or recognizable

TABLE 3
LOCALIZATION IN RABBITS OF STREPTOCOCCI FROM CASES OF GASTRIC ULCER

Source of culture	Rabbits injected	Number of rabbits having lesions of the: Stomach	Duodenum	Stomach and duodenum	Stomach or duodenum or both, per cent	Bowel	Joint	Muscle	Lung	Gallbladder	Kidney	Heart	Spleen
Teeth	13	8			62		1	1	1				
Tonsils	23	9	1	4	61	1	2		1	2	2		
Prostate gland	23	13		2	65	1	4	1	1			1	
Gastric ulcer	37	18	1	5	65	4			1		2	2	1
Total	96	48	2	11		6	7	2	4	2	4	3	1
Total per cent					64	6	7	2	4	2	4	3	1

TABLE 4
LOCALIZATION IN RABBITS OF STREPTOCOCCI OBTAINED FROM CASES OF DUODENITIS, DUODENAL ULCER AND GASTRIC ULCER

Kind of cases from which cultures were taken	Cases from which strains were obtained	Cases strains from which localized in the stomach or duodenum of rabbits	Rabbits injected	Percentage of rabbits having lesions of the: Stomach, duodenum or both	Bowel	Appendix	Joints	Muscle	Nerve	Skin	Eye	Lung	Gallbladder	Liver	Kidney	Heart	Spleen
Duodenitis	21	18	89	51	1	3	6	1				8		1	2		
Dundenal ulcer	134	93	675	52	3	3	6	1	1	1	1	4	2	2	5	3	1
Gastric ulcer	31	24	96	64	6		6	2				4	2		4	3	1
Total	186	135 (73 per cent)	860	52	3	3	6	1	1	1	1	4	2	1	5	3	1
Control group	94	11 (11 per cent)	184	9	5	1	11	5	1	1	3	8	3	2	6	6	

disease, or if they were ill, had no systemic involvement. Consequently, this group contains cultures of teeth extracted for cosmetic reasons, or of teeth, or tonsils, or the prostate gland or cervix of patients with undetermined fever, insomnia, neurasthenia, or similar intangible complaints. Only eleven of ninety-four patients (11 per cent) in the control group harbored streptococci with affinity for the stomach or duodenum, whereas in 73 per cent of the cases of peptic ulcer a streptococcus having special affinity was found. Lesions of the stomach or duodenum developed in only 9 per cent of the rabbits of the control group in contrast to 52 per cent of the rabbits injected with strains isolated from patients with peptic ulcer.

In order to evaluate the significance of streptococci obtained in cultures of surgically resected tissues, four pieces of tissue from an apparently grossly unchanged stomach and duodenum were cultured. From one of the four pieces, a few streptococci were recovered. However, neither this culture, nor any of the other organisms found in cultures of the grossly unchanged stomach or duodenum, produced lesions of the stomach or duodenum in nine rabbits when they were given injections of a dosage the same as or one and a half times greater than, the usual dosage employed.

In table 5, the experimental results in animals are grouped according to the focus from which the strain was obtained. The strains obtained from the teeth, tonsils, prostate gland, and resected ulcers were approximately equally selective for the stomach and duodenum, but those strains obtained from the surgically resected tissue of the duodenum and stomach had even a slightly higher selective affinity. The dominant characteristic is again evident in this table; namely, that no matter what the focus, there is a much higher percentage of lesions in the stomach or duodenum than in any other part of the body. In table 6, the results in animals are divided so that

TABLE 5

COMPARISON OF RESULTS OBTAINED WITH STRAINS ISOLATED FROM VARIOUS FOCI IN CASES OF DUODENITIS, DUODENAL ULCER AND GASTRIC ULCER

Source of culture	Rabbits injected	Percentage of rabbits having lesions of the: Stomach, duodenum or both	Bowel	Appendix	Joint	Muscle	Nerve	Skin	Eye	Lung	Gallbladder	Liver	Kidney	Heart	Spleen
Teeth	209	53	1	1	9	2			1	5	2	1	2	2	
Tonsils	302	51	1	3	4	1	1	1	1	4	2	1	6	3	
Prostate gland	249	51	5	4	8	1	1		1	4	2	1	7	2	1
Surgically resected specimen showing evidence of duodenitis, duodenal ulcer or gastric ulcer	100	66	6	1	2		1			1	2	1	3	3	1

TABLE 6

COMPARISON OF CHANGES IN RABBITS THAT WERE FOUND DEAD WITH CHANGES IN THOSE THAT WERE KILLED BY AN ANESTHETIC

Kind of cases from which cultures were taken	Animal	Average dose, c.c.	Length of life, days	Rabbits injected	Percentage of rabbits having lesions of the: Stomach or duodenum, or both	Bowel	Appendix	Joint	Muscle	Nerve	Skin	Eye	Lung	Gallbladder	Liver	Kidney	Heart	Spleen
Duodenitis	Anesthetized	7.4	7.3	42	57		2	10								2		
	Died	6.9	3.6	47	45		4	2	2				9		2	2		
Duodenal ulcer	Anesthetized	7.5	7.6	256	40	1	2	9	1	1		1	2	3	1	4	3	
	Died	7.5	4.1	419	60	1	4	1	1	1	1	1	5	2	1	6	3	1
Gastric ulcer	Anesthetized	6.4	5.8	38	63	8		10						5			3	
	Died	6.6	5.2	58	66	5		5	3				7				3	2
Total	Anesthetized	7.4	7.4	336	42	2	2	10	1	1	1	1	2	2	1	3	2	
	Died	7.3	4.2	524	59	3	4	4	1	1	1	1	6	1	1	5	3	1
Total				860	53	3	3	6	1	1	1	1	4	2	1	4	3	1

the findings in the anesthetized animals that were dispatched by anesthesia are compared with the findings in the animals that were found dead. The average dose injected was approximately the same in both groups. The rabbits that were dispatched by anesthesia naturally lived a longer time than those that were found dead. However, the percentage incidence of localization in the two groups is not at great variance. The percentage of lesions in the lungs, usually due to pneumonia, was higher among the animals that were found dead than among those that were anesthetized, whereas the latter had a slightly higher percentage of lesions in the joints. The comparative ratios between the situation of various lesions was approximately the same whatever the manner of death. Whether the group of animals that was dispatched by anesthesia is considered alone or the group that was found dead is considered alone, or both groups are considered together, the one outstanding result is unchanged, namely, that the strains obtained from patients with peptic ulcer produced lesions more often in the

stomach and duodenum than in any other part of the body.

The results of cultures obtained at necropsy were also analyzed to compare the pathogenic with the nonpathogenic strains as well as the results in the anesthetized rabbits with those obtained in the rabbits that died. In the anesthetized rabbits injected with pathogenic strains, the streptococcus was recovered from the blood in 32 per cent, from the ulcer in 67 per cent, and from the joints in 11 per cent; septicemia occurred in 11 per cent. In the animals that died the percentages were practically the same, the streptoccus being recovered from the blood in 30 per cent, from the ulcer in 67 per cent, and from the joints in 5 per cent; septicemia occurred in 11 per cent. In contrast, in the anesthetized animals injected with nonpathogenic strains, the streptococcus was recovered from the blood in only 18 per cent and septicemia occurred in 6 per cent. In those that died the blood contained the streptococcus in 26 per cent and septicemia occurred in 4 per cent. Thus there is only a slight increase in percentage of bacteremia and septicemia caused by the pathogenic strains but there is no appreciable difference between the animals that died, and those that were anesthetized. The one prominent feature is that the percentage incidence of recovery of the streptococcus was highest in the specific focal lesions.

It has been suggested that only those results should be included in the tables that had been induced by pathogenic strains which had actually produced some sort of a visible lesion in the rabbits. In order to evaluate this suggestion, all the figures were analyzed again (table 7). It is evident from the table that such exclusion raises the percentage incidence of elective localization. The percentage incidence of localization in the stomach and duodenum in cases of duodenitis is raised from 51 to 61 per cent, in cases of duodenal ulcer from 52 to 65 per cent, and in cases of gastric ulcer from 64

TABLE 7

COMPARISON OF CHANGES IN RABBITS THAT RECEIVED INJECTIONS OF ALL CULTURES WITH CHANGES IN RABBITS THAT WERE GIVEN INJECTIONS ONLY OF PRIMARY CULTURES OF PATHOGENIC STRAINS

Kind of cases from which cultures were obtained	Strains injected	Rabbits injected	Percentage of rabbits having lesions of the: Stomach or duodenum or both	Bowel	Appendix	Joint	Muscle	Nerve	Skin	Eye	Lung	Gallbladder	Liver	Kidney	Heart	Spleen
Duodenitis	Pathogenic when first isolated	57	61	2	5	7					11		2	4		
	All strains	89	51	1	3	6	1				8		1	2		
Duodenal ulcer	Pathogenic when first isolated	482	65	4	5	7	1	1	1	1	5	3	2	6	4	1
	All strains	675	52	3	4	6	1	1	1	1	4	2	1	5	3	1
Gastric ulcer	Pathogenic when first isolated	74	70	7		9	3				5	3		5	4	1
	All strains	96	64	6		7	2				4	2		4	3	1
Peptic ulcer (total)	Pathogenic when first isolated	613	63	4	4	7	1	1	1	1	5	2	2	6	3	1
	All strains	860	52	3	3	6	1	1	1	1	4	2	1	5	3	1
Control	Pathogenic when first isolated	105	13	9	2	17	9	2	2	6	14	6	3	11	11	
	All strains	184	9	5	1	11	5	1	1	3	8	3	2	6	6	

to 70 per cent. Considered collectively, 52 per cent of 860 rabbits that were given injections of the various strains had lesions of the stomach or duodenum. From this figure, 860, was subtracted the number of those rabbits that had been given injections of strains that had gone through one or more animal passages, those strains that did not produce gross lesions on intravenous injection, and those that had been obtained in second cultures from a focus. This left a total of 613 rabbits that had received injections of strains that produced some sort of a lesion in at least one of the rabbits that had been given primary injections. Lesions of the stomach or duodenum developed in 63 per cent of these 613 rabbits. By this method of exclusion, the incidence of localization of strains isolated from the stomach or duodenum is increased from 52 to 63 per cent. Likewise, the percentage incidence of localization in the joints is raised from 6 to 7, in the lungs and kidneys from 4 to 5 and 5 to 6, respectively, in the bowel and appendix from 3 to 4, and the percentage incidence of the remainder of the localizations is too small to be affected. With the use of the same standard for the control group (tables 4 and 7), the percentage incidence in the stomach and duodenum was raised from 9 to 13; in the joints, from 11 to 17; in the lungs, from 8 to 14, and the percentages elsewhere were raised to a less degree. Thus, the application of this method of evaluating the selective affinity of the strains raises the percentage incidence of most of the localizations but it does not change the relative percentages appreciably nor does it change the site of the localizations.

Three of the strains of streptococci also were studied to determine the possible presence of endotoxins and ectotoxins having selective affinity for the stomach or duodenum. Eighteen-hour broth cultures of the organisms were centrifugalized. The supernatant fluid was decanted and passed through a Berkefeld filter (N). The filtrate was proved sterile, and then was injected intravenously into rabbits. The sediment containing the bacteria was washed three times in sterile physiologic solution of sodium chloride, then was diluted to the original volume with physiologic solutions of sodium chloride, and was heated to 60° C. for forty minutes. When it had been proved sterile, it was injected intravenously into rabbits. Thirteen rabbits were given injections in the usual manner with living broth cultures of these three strains. In nine (69 per cent) of the rabbits lesions of the stomach or duodenum developed. The highest incidence of lesions elsewhere in the body was in the kidney (30 per cent). This may be explained partly by the fact that one of the three strains used was isolated from a focus of a patient who had nephritis as well as duodenitis. Then six rabbits were given injections of washed, dead bacteria, suspended in solution of sodium chloride, and in four of the six similar lesions developed. Ten rabbits were given injections with the sterile filtrate obtained from the broth cultures of the organisms, and in nine of the ten hemorrhagic lesions of the stomach or duodenum developed. Six rabbits received injections of similar amounts of the un-

inoculated broth that had been used in making the cultures, and lesions did not develop in any. The dosage of the suspended, dead bacteria was the same as that for the living cultures. The dosage of the filtrate was slightly larger; it varied from 5 to 12 c.c.

Histologic Changes

The microscopic picture of the ulcers resected from human beings resembles that described in textbooks. The microscopic appearance of the duodenum in cases of duodenitis resembles the description of Judd and Nagel. Streptococci have been found repeatedly in the walls of resected ulcers by various investigators. However, fewer attempts have been made to demonstrate their presence in the inflamed duodenum in cases of duodenitis.

Sections of duodenal tissue from twenty-two cases of duodenitis were studied, and in seventeen of the twenty-two (81 per cent) diplostreptococci were found in the sections stained with Gram-Weigert stain. There was often the usual mixture of organisms, mainly Gram-positive and Gram-negative bacilli of various sizes and shapes, many of them spore-forming organisms on the surface of the mucosa and extending down into the crypts. Rarely they also were found in the same places in which the streptococci were found. The diplostreptocci usually were found in the mucosa, near the periphery of hemorrhages, or in the vicinity of regions of cellular infiltration. In some instances in which stippling of the serosa was noticed at the time of operation, the bacteria were found also in the depths of the muscle near the serosa. However, as a general rule, they were not as numerous nor as deeply situated as the streptococci found in cases in which actual ulceration was present.

The experimental lesions, when situated in the duodenum, consisted mainly of submucous petechial hemorrhages, often confluent. Sometimes there was stippling of the serosa of the affected duodenum similar to that described by Judd as characteristic of duodenitis in man. When the lesions were in the stomach they usually were in the pyloric portion, or along the lesser curvature; they were less numerous, more discrete than those in the duodenum, and sometimes the hemorrhagic, necrotic center was sloughed out, producing what resembled a superficial erosion.

Microscopically, the duodenitis in animals resembled the duodenitis as found in man but it was more marked than in man. The mucosa and submucosa often were distended with the products of hemorrhage or were the site of marked cellular infiltration which frequently penetrated the muscularis, and in some instances extended to the serosa. The glandular tissue of the mucosa often was almost entirely replaced by hemorrhage and cellular infiltration.

In sections of the experimental lesions stained by the Gram-Weigert method there was sometimes a mixture of Gram-negative and Gram-positive bacilli, with a few streptococci on the surface of the mucosa. However, in the mucosa and submucosa, adjacent to regions of hemorrhagic or cellular infiltration, the streptococcus, in diplococcus form, usually was found also.

Report of Illustrative Cases

Case 1. Duodenitis with hemorrhage the dominant symptom.—A farmer, aged sixty years, entered The Mayo Clinic in December, 1925, complaining of slight flatulence and occasional heart-burn but no definite gastric distress. Six years previously he had become nauseated and had vomited blood. Following this, he had been fairly well until two years before he came to the clinic when he again had vomited 1 liter of "blood" and had had tarry stools for a week. He had regained and maintained his health until eight weeks before admission, when he had another attack of hematemesis associated with dizziness and syncope. His bowels had been regular in action, his appetite had been only fair, and food had given only occasional relief.

Analysis, on the basis of 100 c.c. of gastric content, revealed total acidity of only 36 and free hydrochloric acid of 20, expressed in terms of cubic centimeters of tenth-normal solution of sodium hydroxide. Duodenal ulcer was diagnosed by roentgenogram. Operation revealed duodenitis without ulceration, involving the pyloric ring.

Figure 1*a* is a section through the excised piece of duodenum. There is no definite ulceration in the duodenum but in places there is marked cellular infiltration and edema. Figure 1*b* is a higher magnification of figure 1*a* and shows the diplococci in the tissues.

Case 2. Experimental results obtained with cultures of resected duodenal tissue as well as of material from foci of infection.—An unmarried woman, aged thirty years, entered The Mayo Clinic in 1925 with a

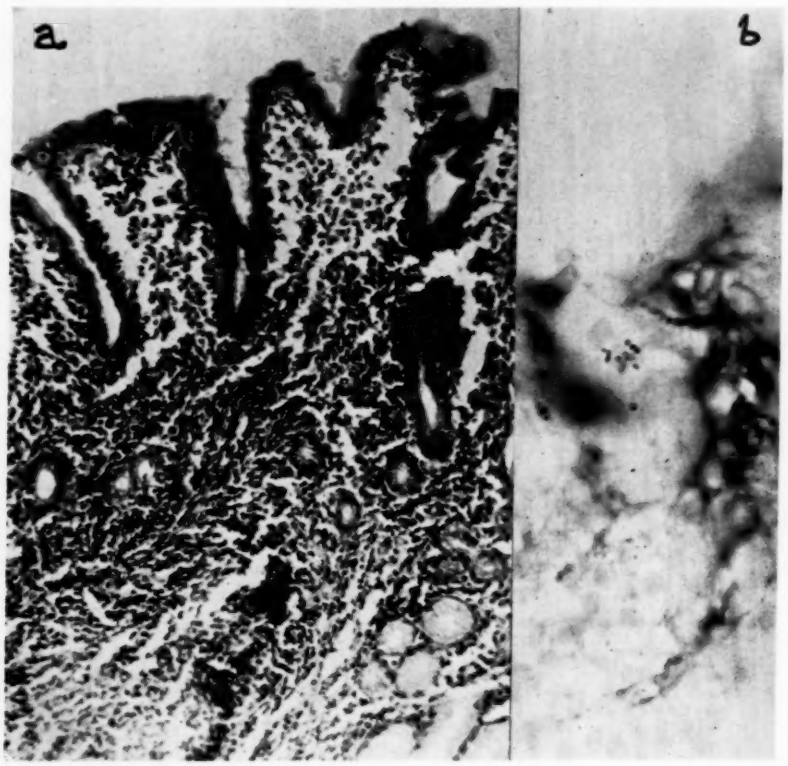

Fig. 1. *a*, Section of surgically removed duodenum of a man. Cellular infiltration and edema characteristic of duodenitis (hematoxylin and eosin, x100); *b*, streptococci situated in the region of the cellular infiltration (Gram-Weigert stain, x1000).

history of gastric distress of long standing. Apples, beans, tomatoes, and similar articles of diet caused severe epigastric distress which radiated to the back and which caused residual soreness in the lower right quadrant of the abdomen. This distress was relieved at times by the taking of soda or food. There was no jaundice, no vomiting and no nocturnal distress. A roentgenogram was positive for duodenal ulcer. At operation there was found marked duodenitis and a very small area of erosion or ulceration. Sections of the inflamed duodenum revealed the usual superficial cellular infiltration with occasional diplostreptococci adjacent to regions of infiltration. Cultures of a piece of the inflamed duodenum, consisting mainly of green producing streptococci, were injected into two rabbits, both of which died two days later with confluent hemorrhages of the pyloric portion of the stomach, but with no other gross lesions. The organism injected, a green-producing streptococcus, was recovered from the blood of one of the two rabbits and then was injected into another rabbit which was dispatched four days later. Necropsy revealed numerous discrete and confluent, irregular, submucous hemorrhages of the first portion of the duodenum (fig. 2). Sections of the duodenum revealed hemorrhagic infiltration of the mucosa (fig. 3) with the microbe in the depths of the mucosa near the regions of hemorrhage (fig. 4).

Summary and Conclusions

The results given in tables 1, 2, and 3 could almost be superimposed on one another. The results in cases of duodenitis and of duodenal ulcer are very similar. The only important difference between them and those obtained in cases of gastric ulcer is the fact that the strains obtained from the patients who had gastric ulcer produced lesions more often in the stomach and less often in the duodenum while the strains obtained from patients who had duodenitis or duodenal ulcer produced

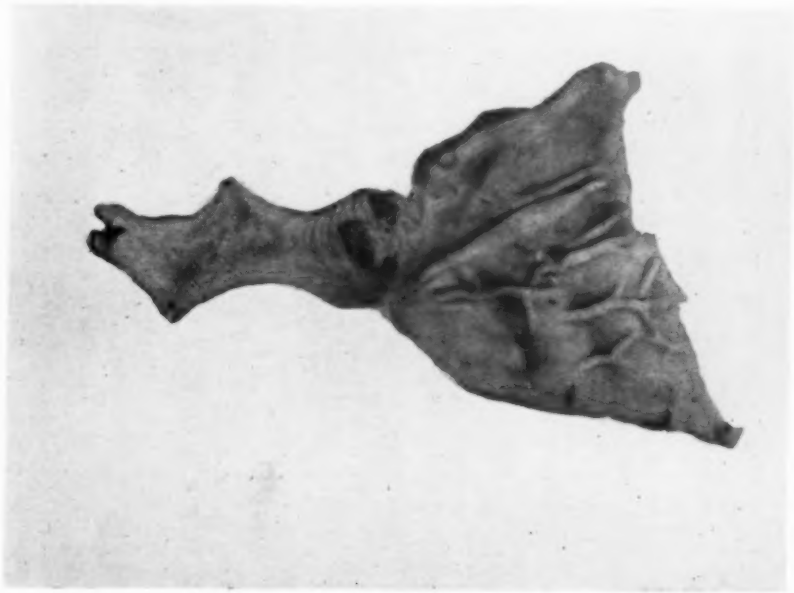

Fig. 2. Submucous hemorrhagic duodenitis in a rabbit, four days after two intravenous injections at intervals of twenty-four hours, of 5 and 6 c.c., respectively of a culture of streptococci in glucose-brain broth.

FIG. 3. Section through a hemorrhagic portion of the duodenum shown in figure 2, with multiple massive hemorrhagic infiltrations extending down to the muscularis (hematoxylin and eosin, x75).

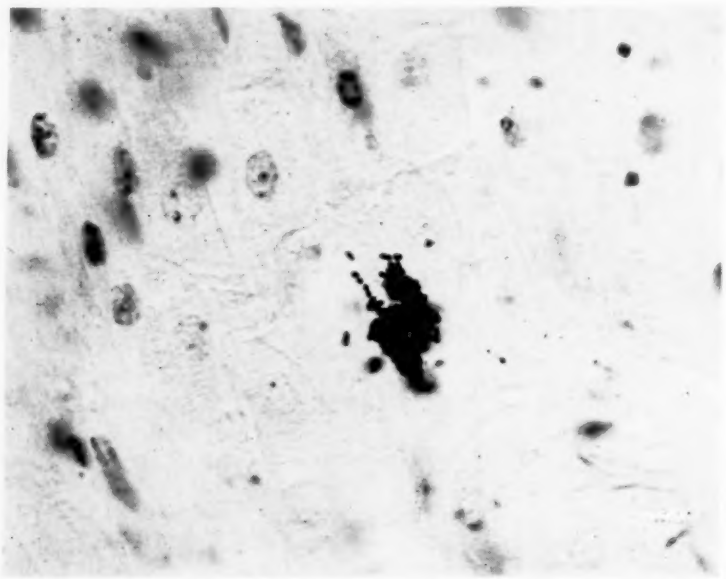

FIG. 4. Diplococci near the periphery of the larger area of hemorrhage shown in figure 3 (Gram-Weigert stain, x1000).

lesions in the duodenum more often than in the stomach.

Whenever the culture of the resected tissue of the stomach or duodenum consisted predominantly of green-producing streptococci, intravenous injection into rabbits caused acute hemorrhagic lesions of the stomach or duodenum in a large percentage of cases. If the culture injected consisted mainly of bacilli, or staphylococci, or other nonpathogenic organisms, focal lesions of the duodenum or stomach or lesions elsewhere in the body were relatively infrequent.

Pure cultures were not injected except as they seemed pure when isolated from the teeth or from the lesion itself. It is common knowledge that the streptococcus loses its selective affinity unless injected when freshly isolated. Consequently injection of pure-line strains obtained from infected foci are of little value since they have been on artificial mediums too long. However, a pure strain recovered from the experimental lesion, if promptly reinjected, usually localizes again electively, and culturally it coincides with one of the strains of the mixed culture originally injected. Concerning intercurrent infections, it is extremely rare to isolate a green-producing streptococcus related to such intercurrent infections which has elective localizing power.

The results from a uniform method of intravenous injection have been analyzed from various standpoints and all the valid criticisms have been satisfactorily answered. These criticisms concerned: (1) the size and number of doses injected; (2) the number of cases and controls studied; (3) the number of animals injected in each case; (4) whether the animals died from the injection or were anesthetized; (5) the intercurrent infection and experimental bacteremia, and (6) whether strains injected were pathogenic or nonpathogenic. Under these controlled conditions the incidence of lesions of the stomach and duodenum were constantly much higher than in tissues elsewhere in the body, and specific lesions produced resembled those in the patient in essential respects.

Thus a streptococcus, like the one isolated and described by Rosenow, has been consistently isolated from various foci of infection and from the surgically removed tissues in cases of duodenitis and of duodenal and gastric ulcer. It has again been demonstrated in the affected tissues of both human beings and of experimentally produced lesions, and it has been shown to have ectotoxins and endotoxins which affect specifically the mucous membrane of the stomach and duodenum. On the bases of these facts, the conclusion that this streptococcus is a causative agent in each of the three diseases studied, seems warranted.

BIBLIOGRAPHY

[1]Boas, I.: Bemerkungen zu dem vorstehenden Artikel. Arch. f. Verdauungskr., 36:305-310 (Dec.) 1925.

[2]Hemmeter, J. C.: Diseases of the stomach; their special pathology, diagnosis and treatment. Philadelphia, P. Blakiston's Son and Co., 1898, p. 788.

[3]Holman, W. L.: Focal infection and "elective localization" critical review. Arch. Path. and Lab. Med., 5:68-136 (Jan.) 1928.

[4]Judd, E. S.: Pathologic conditions of the duodenum. Journal-Lancet, 41:215-220 (April) 1921.

[5]Judd, E. S. and Nagel, G. W.: Duodenitis. Ann. Surg., 85:380-390 (March) 1927.

[6]Karsner, H. T.: The pathology of peptic ulcer of the stomach. Jour. Am. Med. Assn., 85:1376-1380 (Oct.) 1925.

[7]MacCarty, W. C.: Excised duodenal ulcers. Jour. Am. Med. Assn., 83:1894-1898 (Dec.) 1924.

[8]McMeans, J. W.: Experimental bacteremia. Arch. Int. Med., 22:616-646 (Nov.) 1918.

[9]Puhl, Hugo: Über die Bedeutung entzündlicher Prozesse für die Entstehung des Ulcus Ventriculi et Duodeni. Virchow's Arch. f. path. Anat. u. Physiol., 260:1-109 (Aug.) 1926.

[10]Roeder, C. A.: Duodenitis. Nebraska State Med. Jour., 9:252-256 (July) 1924.

[11]Rosenow, E. C.: The production of ulcer of the stomach by the injection of streptococci. Jour. Am. Med. Assn., 61:1947-1950 (Nov.) 1913.

[12]Wellbrock, W. L.: Duodenitis and duodenal ulcer. Ann. Surg., 1930, xci, 533-539.

The Blood Sugar During Remission in Pernicious Anemia

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Introduction

THE similarity of the symptoms of hunger, headache, restlessness and sweating seen in early remission in patients with pernicious anemia after liver therapy and in hypoglycemia has been mentioned by Blotner and Murphy.[1] Investigating the blood sugar reducing properties of whole liver and liver extracts, these authors find an insulin-like, blood sugar reducing action common to whole liver and certain extracts of liver which are ineffective in the treatment of pernicious anemia. The liver extract fraction (G) of Cohn[2] which is effective in the treatment of pernicious anemia, they find does not exhibit this blood sugar reducing effect. In their experiments whole liver given by mouth produced a fall in the blood sugar curves after a carbohydrate test meal in normal persons and patients with pernicious anemia and diabetes, similar to that observed after the use of insulin, and lowered the fasting blood sugar values of patients with diabetes when the liver was eaten daily. From their results it might be supposed that should hypoglycemia be an important factor in the production of hunger during early remission in pernicious anemia, hunger would appear after the use of whole liver but not after the use of an effective liver extract. Such a supposition would be incorrect for intense hunger develops as frequently after the use of an effective liver extract as after whole liver feeding. Apparently some other factor produces the hunger observed in these cases. Curtis[3] attributes the development of hunger symptoms to the presence of large quantities of vitamine B in liver and in effective liver extracts.

Material and Methods

This study deals with the behavior of the blood sugar under fasting conditions during early remission in pernicious anemia. Frequent determinations of the amount of sugar in the blood serum taken under fasting conditions were made in eight patients with pernicious anemia under treatment with liver extract, in one patient with pernicious anemia during a spontaneous remission and in one normal person using liver extract. Usually determinations of the blood sugar values were performed at intervals of one or two days. The blood for each estimation was drawn under fasting

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conditions at 8:00 A.M. The method of Folin and Wu[4] was used in making blood sugar determinations. The periods of observation extended over 8 to 27 days of liver extract treatment, being preceded with one exception by a control period in which estimations of the sugar content of the blood were made while the patient was in relapse.

Lilly's liver extract No. 343 (similar to the fraction (G) of Cohn) was employed in all but two patients, one patient receiving Parke-Davis liver extract, another a liver extract prepared from the livers of cod fish.*

Data on the reticulocyte percentage, the red and white blood cell counts, the amount of hemoglobin, the changes in appetite, the daily food intake in calories and the variations in the weight of these patients were also recorded.

Case Reports

With the exception of M.R. who was a normal person, the persons studied each exhibited the characteristic symptoms, signs, and laboratory findings of pernicious anemia. The treatment given to each patient is recorded in Table No. 1.

No. 1. Mr. G. F. Age 38. First relapse. The patient had had a thyroidectomy two and a half years before for exophthalmic goiter. With development of the symptoms of pernicious anemia, symptoms of hyperthyroidism returned. The basal metabolic rate, +47 before liver extract therapy, fell to +10 during remission. The presence of hyperthyroidism apparently did not influence the fasting blood sugar level since this patient showed findings similar to those found in the other patients. Before liver extract was given the blood findings were: R. B. C. 860,000 per cu. mm., W. B. C. 3,650 per cu. mm., Hemoglobin 19% (Sahli). After 28 days of treatment they were: R. B. C. 3,300,000 per cu. mm., W. B. C. 6,850 per cu. mm., Hemoglobin 61% (Sahli). A typical reticulocyte response followed the use of liver extract, the maximum percentage of reticulocytes being 39.5% on the sixth day of treatment.

No. 2. Mrs. M. F. Age 33. First relapse. The blood findings before treatment were: R. B. C. 1,730,000 per cu. mm., W. B. C. 3,750 per cu. mm., Hemoglobin 39% (Sahli). After 28 days of treatment they were: R. B. C. 3,470,000 per cu. mm., W. B. C. 6,550 per cu. mm., Hemoglobin 68% (Sahli). A typical reticulocyte response followed liver extract treatment, the maximum percentage of reticulocytes being 17.6% on the twelfth day of treatment.

No. 3. Mr. J. K. Age 64. Third relapse. Before treatment the blood findings were: R. B. C. 1,100,000 per cu. mm., W. B. C. 3,750 per cu. mm., Hemoglobin 21% (Sahli). After 17 days of treatment they were: R. B. C. 3,460,000 per cu. mm., W. B. C. 7,850 per cu. mm., Hemoglobin 50% (Sahli). The maximum reticulocyte percentage was 25.9% on the sixth day of treatment.

No. 4. Mr. G. B. Age 60. First relapse. Before treatment the blood findings were: R. B. C. 1,310,000 per cu. mm., W. B. C. 4,350 per cu. mm., hemoglobin 25% (Sahli). After 14 days of treatment they were: R. B. C. 2,350,000 per cu. mm., W. B. C. 6,650 per cu. mm., Hemoglobin 51% (Sahli). The maximum reticulocyte percentage was 28.3% on the sixth day of treatment.

No. 5. Mrs. M. E. Age 48. First relapse. Before treatment the blood findings were: R. B. C. 2,490,000 per cu. mm., W. B. C. 10,250 per cu. mm., Hemoglobin 55% (Sahli). After the 13 days treatment they were: R. B. C. 3,200,000 per cu. mm., W. B. C. 10,600 per cu. mm., Hemoglobin 70% (Sahli). A maximum reticulocyte percentage of 7.9% occurred on the sixth day of treatment.

No. 6. Mr. C. S. Age 56. First relapse. During fifteen days of treatment the blood findings improved from R. B. C. 1,370,000

*Marine Liver Extract (G-127) prepared by White Laboratories, Inc., Gloucester, Mass.

per cu. mm., W. B. C. 5,650 per cu. mm., Hemoglobin 30% (Sahli), to R. B. C. 2,790,000 per cu. mm., W. B. C. 7,000 per cu. mm., Hemoglobin 58% (Sahli). A maximum reticulocyte percentage of 26.1% was observed on the seventh day of treatment.

No. 7. Mr. S. M. Age 68. First relapse. Before treatment the blood findings were: R. B. C. 1,120,000 per cu. mm., W. B. C. 3,600 per cu. mm., Hemoglobin 29% (Sahli). A maximum reticulocyte percentage of 25.9% was observed on the fifth day of treatment. Observations on the fasting blood sugar were discontinued on the seventh day of treatment as facial erysipelas developed.

No. 8. Mr. M. U. Aged 49. Seventh relapse. Pernicious anemia was associated in this patient with tapeworm infection, the tapeworm having been removed two weeks before treatment. The initial blood findings were: R. B. C. 990,000 per cu. mm., W. B. C. 4,400 per cu. mm., Hemoglobin 26% (Sahli). After 14 days of treatment: R. B. C. 2,260,000 per cu. mm., W. B. C. 5,350 per cu. mm., Hemoglobin 37% (Sahli). A maximum percentage of reticulocytes of 28.0% was observed on the sixth day of treatment.

No. 9. Mr. M. R. Normal person.

No. 10. Mrs. D. R. Age 40. First relapse. Without treatment the patient developed a spontaneous remission, the maximum reticulocyte percentage being 18.4% on the fourth day of observation. See Table No. 2.

The Behavior of the Blood Sugar During Early Remission

The fasting blood sugar values obtained during liver treatment from a normal person and eight patients with pernicious anemia are shown in Table 1. The values obtained in the normal person, M. R., used as a control, varied from 92 to 105 milligrams of sugar per 100 c.c. of blood without liver extract treatment. During a ten day period of liver extract treatment the values obtained varied from 86 to 105 mgms. per 100 c.c. of blood. These changes were not considered significant.

Fasting blood serum values were obtained before treatment in seven of the eight patients. These values during relapse varied from 72 to 114.5 mgms. sugar per 100 c.c. of blood, all within normal limits. The usual value observed before treatment was in the neighborhood of 100 to 110 mgms. per 100 c.c. of blood. Following treatment in these seven patients all except two exhibited a decrease in blood sugar values of from 23 to 44 points. In the two exceptions, one, S. M., was observed an insufficient length of time to see the maximum decrease expected and in the second patient, M. E., the original level of the red blood cell count was high and the reticulocyte response feeble. The lowest blood sugar values, varying between 61 and 83 milligrams per 100 c.c., were seen from seven to seventeen days after the beginning of treatment. If observed over a sufficient length of time the blood sugar values tended to rise slightly. An example of the change in the blood sugar values during liver extract treatment is shown graphically in Chart No. 1.

The patient with pernicious anemia in spontaneous remission (D. R.) showed a fasting blood sugar value of 133 mgms. per 100 c.c. on the first estimation, the lowest value obtained being 91 mgms. per 100 c.c. two days later, a drop of 42 points. Subsequently the blood sugar value rose to 103 mgms. per 100 c.c. in this patient. (See Table No. 2.)

Relation of Appetite to Blood Sugar Level

In seven of the nine patients used in this study the appetite was distinctly poor before treatment being only fair

TABLE NO. 1

FASTING BLOOD SUGAR VALUES UNDER LIVER EXTRACT THERAPY

Milligrams Sugar per 100 c.c. Serum

	1	2	3	4	5	6	7	8	9
Day of Treatment*	G.F.	M.F.	J.K.	G.B.	M.E.	C.S.	S.M.	M.U.	M.R.
—4	93	...	...	...	...	...	...	...	104
—3	88	87	...	...	87	...	...	...	...
—2	...	...	100	...	...	...	...	...	105
—1	107	...	...	...	72	113	87	...	...
0	...	...	...	111	...	...	...	...	92
1	...	90	98	88	74	111	100	...	...
2	...	...	98	91	82	...	95	...	105
3	79	84	94	87	75	98	91	...	...
4	...	...	106	98	...	...	96	...	95
5	87	...	98	89	79	96	83	62	...
6	...	93	86	78	...	...	87	...	86
7	69	89	101	67	79	93		...	...
8	...	69	87	76	...	...		...	99
9	...	83	84	76	74	...		...	...
10	...	83	80	80	...	...		...	100
11	77	76	80	74	76	78		...	...
12	...	67	83	82	...	...		79	103
13	80	...	79	80	79	72			
14	...	75	77	83		...			
15	77	...	80			78			
16	...	61	80						
17	67	...	83						
18	...	61							
19	80	...							
20	...	69							
21	69	...							
22	78	74							
23	...	...							
24	93	76							
25	...	...							
26	84	73							
27	...	...							
28	...	80							

		DIAGNOSIS		TREATMENT
*1.	G.F.	Pernicious	anemia—	Lilly's liver ext. 6 vials daily 0-16 and 24-26
2.	M.F.	"	" —	Marine liver ext. 48 c.c. daily 0-22 Lilly's liver ext. 3 vials daily 23-28
3.	J.K.	"	" —	Lilly's liver ext. 6 vials daily 0-3 Parke-Davis liver ext. 6 vials daily 4-17
4.	G.B.	"	"	—Lilly's liver ext. 6 vials daily 0-14
5.	M.E.	"	"	— " " " 4 " " 0-13
6.	C.S.	"	"	— " " " 6 " " 0-15
7.	S.M.	"	"	— " " " 30 " at 0. No further medication.
8.	M.U.	"	"	— " " " 6 " daily 0-12
9.	M.R.	Normal control		— " " " 6 " " 0-8

in the remaining two. Subjectively there was an increase in appetite in all cases after liver extract therapy. The improvement in appetite began during the first week of treatment when the percentage of reticulocytes was increasing and the amount of sugar in the blood decreasing.

The appetite, being a subjective phenomenon, is difficult to evaluate in concrete terms so the daily caloric intake and the changes in body weight were used as indices of the appetite. In every patient there was an increase in weight and food intake which began a few days after liver therapy was

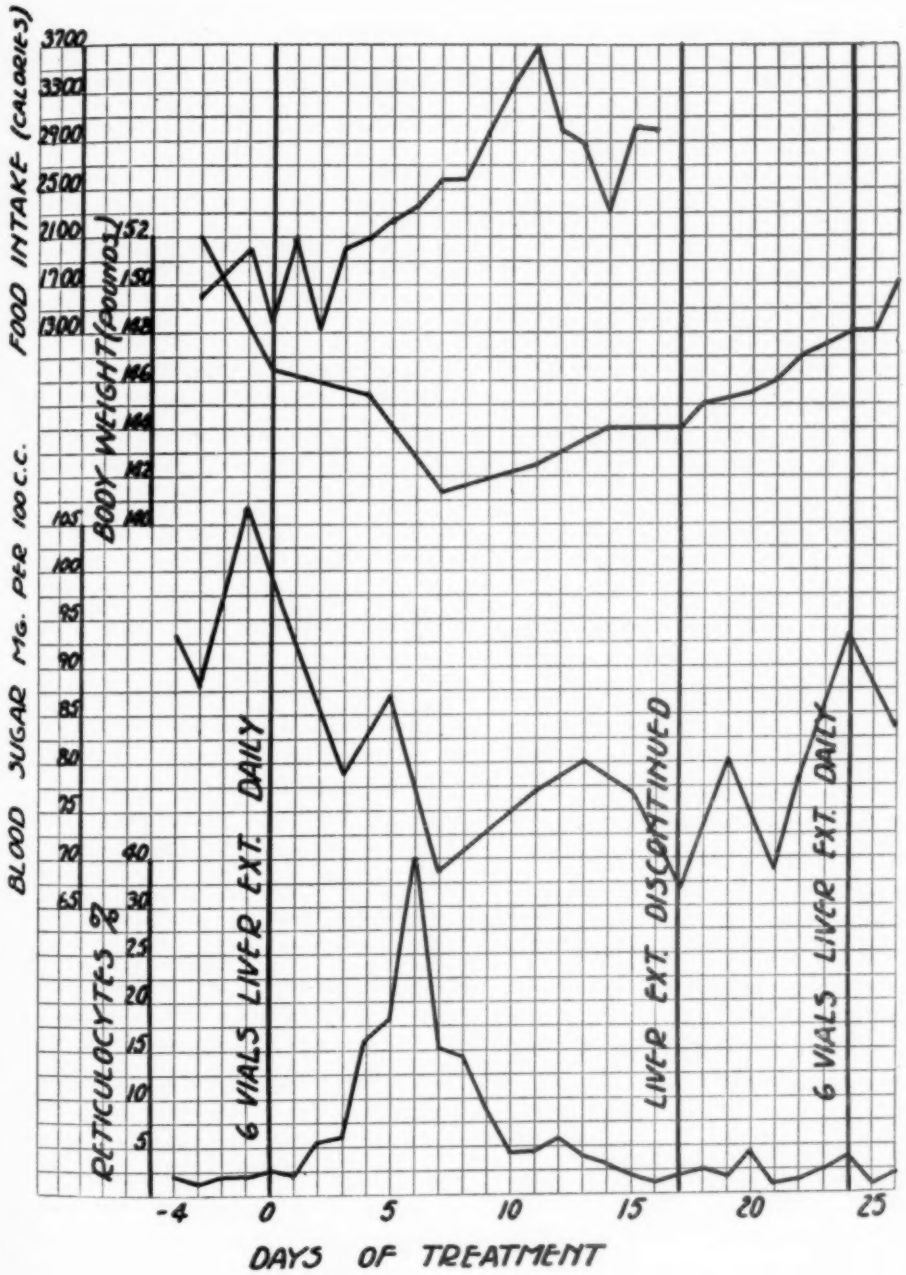

CHART No. 1

Changes in caloric intake, weight, fasting blood sugar values and the reticulocyte percentage during liver extract treatment. (Patient No. 1).

TABLE No. 2
FASTING BLOOD SUGAR VALUES DURING SPONTANEOUS REMISSION
PATIENT D. R.

Days of Observation	Blood Sugar mgm. per 100 c.c.	% Reticulocytes	Red Blood Cells Millions per cu. mm.
1	...	7.5	1.02
2	...	10.2	1.01
3	133	17.9	...
4	...	18.4	...
5	91	11.9	...
6	...	9.6	...
7	91	9.6	1.64
8	...	7.3	...
9	101	8.0	...
10	...	6.8	1.56
11	...	5.5	...
12	103	2.2	1.76

started. The increase in the daily caloric intake began as a rule on the third, fourth or fifth day of treatment, the increase in weight on the fifth to seventh day of treatment. The amount of sugar in the blood of these patients decreased as the caloric intake and weight began to increase. The fasting blood sugar values remained low during the period of rapid gain in weight, caloric intake and appetite. The increase in appetite was as a rule roughly proportional to the decrease in the amount of sugar in the blood. In Chart No. 1 is shown the relation between the caloric intake, body weight, fasting blood sugar and reticulocyte percentage in patient G. F. during the early part of a remission produced by liver extract therapy. In this case the discontinuation of liver extract, was followed by a rise in the fasting blood sugar values although the increase in weight and food intake continued.

The cause for the lowered fasting blood sugar values during early remission must, for the present, remain a matter of speculation. The evidence at hand suggests that the decrease of the sugar in the blood is probably not produced by a blood sugar reducing, insulin-like substance in liver extract. Blotner and Murphy[1] found blood sugar reducing substances absent from liver extracts effective in pernicious anemia. In the patient D. R., in whom remission was spontaneous and to whom no liver material was given, the fasting blood sugar values decreased in the same fashion as in patients in whom remission was induced by the use of liver extract. Patient S. M. was given 30 vials of liver extract during the first day of treatment. The decrease in his fasting blood sugar values continued for eight days although no further liver extract medication was given, observations being discontinued at the end of that time because he developed erysipelas. These facts suggest that the fall in the fasting blood sugar values during early remission are an expression of some metabolic readjustment which accompanies remission rather than the direct effect of liver extract upon the amount of sugar in the blood. Further investigation is necessary to demonstrate the rôle which the low sugar content of the blood during early remission plays in the production of an improvement in appetite. The relation of low values

of the blood sugar to remission is also interesting as various European authorities have used insulin successfully either alone or in conjunction with liver therapy[5] [6] [7] in the treatment of pernicious anemia.

Conclusions

1. A decrease in the amounts of sugar in the blood of patients with pernicious anemia takes place during early remission.

2. The fall of the fasting blood sugar values appears to be related to a metabolic adjustment accompanying early remission rather than to a direct effect of liver extract on the blood sugar level.

3. The fasting blood sugar values may fall as low as 61 mgms. per 100 c.c. of blood during early remission in pernicious anemia.

4. An increase in appetite, caloric intake and body weight is associated with lowered blood sugar values during early remission in pernicious anemia.

5. Further investigation is required to demonstrate the relation of the decreased blood sugar values to the improvement in appetite observed during early remission in patients with pernicious anemia.

BIBLIOGRAPHY

[1]Blotner, H. and Murphy, W. P.: Jour. Am. Med. Assn., 92, 1332, (1929).

[2]Cohn, E. J., Minot, G. R., Alles, G. A. and Salter, W. T.: Jour. Biol. Chem., 77, 325. (1928).

[3]Curtis, A. C.: Jour. Clin. Investigation, 7, 518, (1929).

[4]Folin, O. and Wu, H.: Jour. Biol. Chem., 41, 367, (1920).

[5]Walinskey, F.: Deutsch. med. Wochenschr., 52, 1462, (1926).

[6]Weil, P. E.: Bull. et Mem. Soc. Med. d. hôp. de Paris, 51, 1169, (1927).

[7]Von Vagra, L.: Deutsch. med. Wochenschr., 55, 433, (1929).

Diabetic Coma: A Report of Eighty-one Instances

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THE object of this report is twofold, first to record the cases of diabetic coma that have come under our observation since insulin, January 1923 to September 1929, and secondly to report a series of cases, the majority of which have been treated with alkali in addition to insulin.

The clinical features of diabetic coma have been so thoroughly described in recent, widely published, communications that we only wish to emphasize a few of the striking symptoms. All of the cases in this group were in clinical coma; characterized by a high degree of hyperpnea, signs of dehydration, circulatory weakness, and stupor or unconsciousness. Other symptoms such as vomiting, pain in the abdomen, and hypothermia, while usually present, were not always encountered.

The patients in this series came from a mixture of sources; the majority from the private and clinic practice of one of us. Twenty-four of the patients, however, were admitted to the hospital wards without our having had any previous information as to their cases. Two of them developed coma while in the hospital, one while under treatment for diabetes and the other acute diabetes and coma while receiving treatment for another disease. Diabetes had not been diagnosed until coma appeared in nine of the cases. Two of the patients who died were treated at home by insulin alone for a day before admission.

The causes of coma as far as could be determined were as follows: infraction of dietary rules, 41 instances, the omission of insulin, 13 instances, and infection, 12 instances. Insulin was omitted for various reasons—vomiting, the extraction of teeth so that the patient could not eat, the breaking of an insulin syringe and failure to have another in reserve, self experimentation, carelessness and indifference. In 1927 within a period of ten days, four cases of coma, precipitated by the abrupt withdrawal of insulin, were seen, two having omitted but two doses. This is an unpremeditated experiment, as convincing as those of Hedon[1] who produced typical diabetic coma in partially depancreatized dogs by getting them in good flesh by the use of insulin and then suddenly withdrawing it. Since this experience we have written to all severe diabetic patients warning them of the danger of omitting insulin for any reason except on the advice of their physician, and, judging from the number of types of coma cases that we have seen in the past year, the warning has been heeded. The infraction of dietary rules will probably always be the greatest cause of coma; we believe with Joslin that the frequent

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periodic visits to a physician or clinic is the most efficient safeguard that a diabetic patient may have. Infections should not precipitate coma if the patient and the physician realize their importance to the diabetic; under such circumstances the insulin should usually be increased, the diet reduced and the infection be treated radically if possible. In short it would appear that the majority of instances of coma could be eliminated, except in the small percentage who, because of indifference, will break diet, the severe diabetic patient whose coma threshold is very low, and lastly in the patient who is improperly carried through an infection.

Eighty-one instances of coma in sixty-three patients comprize this group. Of these, forty-five were females and eighteen males. Seven had more than one attack and three were common offenders; two with five attacks and one with six. None of the patients with repeated attacks were lost. Fifteen of the instances occurred in children under 15; none were fatal. Ten patients died either during or following the attack; these will be discussed later. Of the remaining fifty-four we have information of forty-four; six of them have died since leaving the hospital.

Laboratory Examinations

Blood sugar.—This was obtained in sixty-four instances before treatment was started. The maximum was 1320 mgms. and the minimum was 266 mgms. It exceeded 400 mgms. in fifty-three instances, 83 per cent.

CO_2 capacity of the plasma.—We were able to get this determination in fifty of the cases before insulin was given. The variation was between 3.5 and 15 mm., thirty-one of them being less than 7 mm., 62 per cent.

Blood urea nitrogen.—This was studied during the coma phase in forty-one of the eighty-two cases, the figures varying between 8.1 and 123 mgms. per 100 c.c. Thirty-three of these exceeded 20 mgms., 75.5 per cent.

Leucocytes.—A white count was obtained upon admission in forty-seven of the cases. The variation was between 6,000 and 44,000 per cu. mm. The count exceeded 15,000 in thirty-five or 74 per cent of the cases.

Treatment.—While treatment would be unsuccessful in every case of true diabetic coma without insulin, other measures are equally important and patients do not respond satisfactorily when insulin alone is used as was demonstrated in two of our patients who were treated at home before being admitted to the hospital. As soon as the diagnosis was established, which in the usual case requires but a glance, insulin was given, generally 50 units. The ambulance doctor was always equipped to give insulin at home. When it was known that a patient was expected, the ward nurse, house physician, laboratory and ambulance doctor were notified and, if possible, the home was requested to have extra blankets and hot water bottles ready. The patient was placed in a warm bed and disturbed and uncovered only as necessary. A hypodermoclysis of 1000 c.c. of normal salt solution was given. An enema was given if the bowels had not moved that day and in the great

majority of cases alkali in the form of sodium bicarbonate, 5 per cent solution, was given by proctoclysis. In this group it was administered to sixty-three or 76 per cent. The total dose for the first twenty-four hours never exceeded 40 grams and the average dose was about 30. Frequently if no vomiting was present and the patient was able to swallow it was given by mouth or through the stomach tube after lavage. We found it necessary, however, to wash out the stomach but rarely as it usually is quite an arduous procedure for a coma case who has such a weakened circulation. Sodium bicarbonate was given intravenously in but two cases and lately it has been abandoned altogether under ordinary circumstances. Insulin, after the initial dose, was given in varying doses, 10 to 30 units, every two to four hours until the Benedict test began to retain some of its blue color. As a rule no carbohydrate was given until this condition was obtained, when orange juice was attempted. If vomiting was still present, glucose in a 5 per cent sterile solution was given subcutaneously in doses of 500 c.c. every six or eight hours, preceded by a fair dose of insulin. The average insulin dosage for the first twenty-four hours was 150 units, some requiring three times that amount while others responded to one-half that dosage. This requirement did not appear to have any direct relationship to the height of the blood sugar, the CO_2 capacity of the plasma, the degree of leucocytosis, or the blood nitrogen, although we usually expected a patient with extreme hyperglycemia to tolerate more insulin; when the initial blood sugar was low, carbohydrate was given with the insulin. Frequent urine examinations, so that the progress may be watched and the insulin-carbohydrate dosages estimated, are important. When possible, the urine was examined by the nurse before each insulin administration and if the urine was nearly sugar free the interne was informed.

In the earlier years all patients were catheterized if they could not void voluntarily, but in the past two years this practice has been given up, unless the bladder is distended, because two patients developed urinary tract infection following repeated catheterizations, which interfered with convalescence. At the present time we make frequent blood sugar examinations if it is impossible to get urine specimens for testing. It is quite safe usually to rely upon experience alone as insulin reactions during the coma phase are exceedingly infrequent.

Nearly every coma manifests a degree of circulatory insufficiency, hypotonia, tachycardia and acro-cyanosis. The exact nature of this disturbed function is not understood; dehydration and toxemia caused by acidosis have been blamed, nevertheless caffeine sodium benzoate or a reliable hypodermic digitalis preparation have been used in our cases. It is impossible to determine their efficacy as one or the other has been used in all cases; recently, however, digitalis has been routinely employed and caffeine sodium benzoate has been reserved as an emergency stimulant. The fluid intake in the first twenty-four hours was from three to six liters and as a large amount of this was retained, it

gives one an idea of the tremendous dehydration present in these cases. After the emergency measures were well started the patient was carefully examined for infection and appropriate special treatment instituted where necessary. If there was need for the evacuation of pus, it was done immediately. The average case received a diet of orange juice on the second day, milk on the third and fourth, then a soft diabetic diet and an ordinary diabetic diet usually at the end of a week.

The urine of our patients was frequently examined for albumin and casts as they are usually present in the early stages. The blood nitrogen in the majority of patients upon whom it was determined was found elevated early, and patients whose convalescence was unexplainedly protracted often had an increase in blood nitrogen after the coma phase had passed. Oliguria which we felt was caused by renal insufficiency was seen in a few cases.

The treatment of coma, while it may be carried on successfully at home with the assistance of nurses, is much more advantageously handled in the hospital, where a coordinating organization exists.

Complications in Patients Who Survived Coma

Mild upper respiratory tract infections	6
Otitis media	3
Pregnancy with caesarean section	1
Abscess of leg; acute nephritis with urinary suppression	1
Measles	1
Pulmonary tuberculosis	2
Acute salpingitis	1
Empyema of the antrum; perirectal abscess	1
Acute tonsillitis; furunculosis	1
Erysipelas	1
Cysto-pyelitis	4
Abscess of the jaw	1
Miscarriage after coma phase	1
Cellulitis of the foot	2
Arthritis	1
Lobar pneumonia	1
Acute nephritis; urinary suppression	2

Complications, some of serious natures, occurred in about 50 per cent of our cases. Three cases of acute nephritis and oliguria or suppression which have been published in a separate article occurred. One of our patients had a Caesarean section during coma and improved as soon as the uterus was emptied. Our case of lobar pneumonia and coma in a girl of thirteen, with very severe diabetes, had a stormy course for several days, but finally recovered after a protracted febrile period caused by delayed resolution.

Abstract of Cases That Died

Case 1.—A woman of 27 years. Coma developed a week after the omission of insulin. She was in that state twelve hours before admission during which time the only treatment was 200 units of insulin. Extreme circulatory weakness developed in the interim between when she was seen at home and her admission, at which time it was impossible to feel the pulse or to measure the blood pressure. Blood sugar on admission, 500 mgms. Heart rate, 160. Cyanosis and dehyration, extreme. Respirations, 60. During the twelve hours that she lived, 100 units of insulin, 4500 cc. of fluid in the form of salt solution both subcutaneously and intravenously, glucose, 5 per cent solution, both per rectum and subcutaneously, and sodium bicarbonate, 35 grams per rectum in a 5 per cent solution, were administered. The stomach was lavaged. Digitan, 9 ampules, (0.8 gram of powdered digitalis) were given subcutaneously. Oxygen was administered with the McKesson apparatus for several hours before death. No necropsy permitted.

Case 2.—A woman of 52 years. The patient was admitted to the hospital in coma. Blood sugar, 490 mgms. per 100 cc., CO_2 capacity of the plasma, 7 mm., urea nitrogen in the blood, 27 mgms., leucocytes, 26,000 with 92 per cent of polymorphonuclear cells. In the first twenty-four hours 130 units of insulin, 3000 cc., of fluid, and caffeine sodium benzoate, 7 ampules were given. The patient received no alkali. A decubitus ulcer on the buttock appeared on the sixth day. Recovery from coma was complete and the diabetes was gotten under control but on the seventh day fever and a chill developed which was followed by increasing signs of cardiac failure. The leucocyte count again rose to 28,000. No positive clinical diagnosis was made and the patient died on the thirteenth day. Necropsy showed septicopyemia, purulent myocarditis and pericarditis, hepatitis and nephritis.

Case 3.—A man of 30 with a gangrene of the leg entered the hospital in coma. Blood sugar, 500 mgms., CO_2 capacity of the plasma, 5 mm., blood urea nitrogen, 36 mgms., leucocyte count, 21,000. During the first twenty-four hours he received 130 units of insulin, 2000 cc. of fluid, 35 grams of sodium bicarbonate and caffeine sodium benzoate, 0.6. He was catheterized. He responded well to treatment with the exception that he was stuporous most of the time; the blood sugar remained fairly normal and the urine was sugar free. His leg was amputated on the tenth day. An insulin reaction occurred on the eleventh day because of refusal to take food. On the twelfth day he developed high fever and respiratory difficulty and died within a few hours. There was no necropsy but the diagnosis of probably pulmonary thrombosis was made. The arteries of the amputated leg showed arteriosclerosis especially in the distal portions.

Case 4.—A woman of 40 years, entered the hospital with facial erysipelas and coma. Blood sugar, 532 mgms., CO_2 capacity of the plasma, 7 mm., leucocyte count, 9,800 with 79 per cent of polymorphonuclears. She received 165 units of insulin, 40 grams of sodium bicarbonate, 0.7 powdered digitalis, and 8,000 cc. of fluid in the first twenty-four hours. During the following twenty-four hours she received two 10 cc. ampules of Birkhaug's anti-streptococcus serum. The blood sugar came to normal and the urine became free of sugar but the patient did not improve, except that the hyperpnea disappeared and the stupor diminished. The temperature remained high, 102.0°F. to 104.0°F., and the erysipelas extended. She died on the sixth day.

Case 5.—A farmer of 51 entered the hospital in coma. The blood sugar was 432 mgms., CO_2 capacity of the plasma, 7 mm., blood urea nitrogen, 35 mgms., and the leucocyte count, 10,000. His pulse rate was 130 and the blood pressure was 130 systolic and 60 diastolic. He received 140 units of insulin, 35 grams of sodium bicarbonate and 4,000 cc. of fluid in the first twenty-four hours. He responded well to treatment but had an insulin reaction thirty-six hours after admission so that it was necessary to give glucose intravenously. At the end of forty-eight hours he experienced a sudden severe attack of dyspnea and died within a few minutes. The post-mortem blood sugar taken immediately was 104 mgms. and the urine obtained by catheterization showed a trace of sugar.

Case 6.—A woman of 40 who had been ill for four days with vomiting and pain in the abdomen before admission. She had received no specific treatment except 70 units of insulin shortly before her admission. Hyperpnea and dehydration were marked. She received 150 additional units of insulin, 40 grams of sodium bicarbonate, 11 ampules of digitan (1.0 powdered digitalis), 7 ampules caffeine sodium benzoate, and 4,500 cc. of fluid during the first twenty-four hours in the hospital. The following morning the blood sugar was 274 mgms. and the CO_2 capacity of the plasma was 23 mm. The leucocyte count on admission was 19,000. The hyperpnea and the evidence of dehydration disappeared but the patient remained stuporous. She developed fever on the second day which became very irregular and reached 104.0°F. on the seventh day. The leucocyte count dropped to 3,800. There was no satisfactory explanation for the fever. The spinal fluid was negative but unfortunately a blood culture was not done. The

blood urea nitrogen rose to 66 mgms. and the urine showed increasing albumin and casts. She died on the eighth day.

Case 7.—A woman of 49 omitted insulin while on a three day automobile trip. She was admitted to the hospital in coma. Pronounced circulatory failure and cyanosis were present. Pulse, 110; rectal temperature 96.0°F.; blood pressure 96 systolic and 60 diastolic; blood sugar 460 mgms. During the eight hours before she died she received 80 units of insulin; fluids, 2,400 cc., caffeine sodium benzoate 1.0 and sodium bicarbonate, 5.0. The patient died within a few minutes following the intravenous administration of 125 cc. of 5 per cent glucose and 3 per cent sodium bicarbonate solution.

Case 8.—The patient, a woman of 47 years, was known to have had hyperthyroidism and an increased basal metabolism prior to her admission in coma. The pulse was 166; rectal temperature 96.4°F.; blood sugar 400 mgms.; and the CO_2 capacity of the plasma was 9.5 mm. The patient was given 165 units of insulin, sodium bicarbonate, 3 per cent solution and glucose, 5 per cent solution intravenously. Her blood sugar five hours later was 500 mgms. She died without having shown any signs of improvement ten hours after admission.

Case 9.—A woman of 39 entered in coma. Her pulse rate was 160 and the rectal temperature was 101.0°F. She received 140 units of insulin, 2,300 cc. of fluids of which 800 cc. was a 3 per cent sodium bicarbonate solution given per rectum, and caffeine sodium benzoate, 2.0. Her blood sugar was 308 mgms. the morning following admission. The symptoms of acidosis improved but the pulse rate remained high. Hyperthyroidism was suspected because of extreme restlessness, tachycardia, flushing of skin, precordial pain, and sweating. Lugol's solution, 2.0, was given. Her circulation failed rapidly at the end of fourteen hours, which event came on with surprising rapidity and which in our hands was unresponsive to treatment. She became moribund in sixteen, and died eighteen hours after admission. Adrenalin chloride was given subcutaneously and also into the heart.

Case 10.—A stout woman of about 50 was admitted to the surgical service because of alleged osteomyelitis of the femur. The only history obtainable was that she had been ill about five days. She was extremely hyperpneic, dyspneic and cyanotic. There were signs of consolidation of the base of one lung. Diabetes was suspected because of hyperpnea and coma. The blood sugar was 400 mgms., and the leucocytes were 18,000; rectal temperature, 103.0°F., pulse rate, 120. She received 70 units of insulin, caffeine sodium benzoate, 2.0, fluids, 2,000 cc., but no alkali. Her condition which seemed hopeless from the first became gradually worse and she died in eight hours.

It will be seen that most of these cases died of irremediable complications; five of them died after coming out of coma. Infection probably precipitated the coma in cases 3, 4, and 10. It appears that only cases 1, 8, and 9 died of uncomplicated coma, but as necropsies could not be secured, we cannot be certain. In cases 1 and 8 there was extreme hypotonia which did not improve with treatment and in case 9, a woman of 39 with suspected hyperthyroidism died unexpectedly. Serious circulatory disturbances are so common in diabetic coma that Dr. Werner J. Rose has made an electrocardiographic study of a group of these cases. He found no electrocardiographic indication that there was myocardial damage.

Incidental Findings

Five cases showed a rather paradoxical finding in that they were complicated by infection and yet failed to develop leucocytosis as is the rule in an uncomplicated coma case; one with extensive lobar pneumonia never exceeded 10,000 per cu. mm., the highest count in one with pyelitis was 5,300,

one with an abscess of the jaw had but 13,000, another with erysipelas had 10,700, and a child with measles had 5,000. Two patients developed clinical paroxysmal auricular fibrillation during the coma phase; both recovered.

Abdominal pain of varying degrees was found to be an exceedingly frequent early symptom of coma. It was occasionally severe enough to prompt the use of morphine and in several instances it was sufficiently misleading to cause the physician to diagnose an intraabdominal lesion requiring surgical treatment. We had no explanation for this pain but apparently it is directly associated with the acidosis as it disappears soon after the institution of treatment.

The Use of Alkali

The value of alkali in the treatment of diabetic coma is still in a controversial state. Joslin[2] has amply proven that coma may be effectively treated without its use. In his recent report of 105 instances of coma in 90 patients, there were 14 deaths; 2 were uncomplicated, 5 were complicated and 7 died from complications within a short time after recovery from coma had taken place. Sodium bicarbonate was given in 76 per cent of the instances in our cases; the total dose for the first twenty-four hours never exceeded 40 grams and it was rarely given on the second day. The manner of administration was usually by proctoclysis, occasionally by mouth and in two instances small amounts were given intravenously. The average case of diabetic coma apparently does not require alkali to make a satisfactory recovery but it has been our clinical impression that cases respond faster and that they are more readily relieved of hyperpnea, which is often distressing, when alkali is used. In cases accompanied by nephritis, urea retention, and oliguria or suppression of urine, such as were reported by Bowen and Beck[3] in 1925, the employment of sodium bicarbonate seems to be justified, as in these cases improvement did not take place until alkali was given. John[4] has recently reported a similar experience in one case. There does not appear to be any sound contraindication to its use except the fear of alkalosis; this did not occur clinically in our cases, but care was taken to place a "stop order" on the dosage. Hartmann and Darrow[5] have recently reported a comparative study of the composition of the plasma in severe diabetic acidosis and the changes taking place during recovery in cases treated with insulin, water and carbohydrate, but without salt or alkali, cases treated with insulin, carbohydrate and Ringer's solution but without alkali, and cases treated with insulin, carbohydrate, Ringer's solution and alkali. They find that the base-bicarbonate and hydrogen ion concentration were restored slowly by the use of insulin and water and it is their belief that salt solution adds little toward the early recovery of plasma bicarbonate. They state, however, that sodium bicarbonate when given with insulin, carbohydrate, and salt solution, may provide a rapid, safe and complete relief from acidosis. They too comment on the rapid restoration of normal breathing following the administration of alkali as we have observed.

Summary and Conclusions

Diabetic coma constitutes an acute metabolic disturbance and like all accidents is largely preventable. When treated as an emergency nearly every patient, unless his case be complicated by a serious disease, should recover unharmed and often benefited in that he has learned a valuable lesson. It does not appear that coma can be entirely eradicated as diabetes often is not diagnosed until coma appears, also a certain percentage of patients even if they be carefully taught are normally careless and indifferent and some severe diabetic patients, even though they take good care of themselves, may easily be swung into coma by a trivial circumstance.

We wish to emphasize abdominal pain as an exceedingly frequent early symptom of impending diabetic coma.

Death from uncomplicated coma occurred as far as could be determined in three of our sixty-three patients. In all cases there was evidence of circulatory failure, hypotonia, tachycardia and cyanosis. The nature of this is not understood, but it probably is a result of acid intoxication, as in our experience cases that were treated early did not manifest this disturbance.

The use of sodium bicarbonate, 40 grams or less during the first twenty-four hours, in addition to the insulin, salt solution and water appears to be harmless and in some cases we believe that alkali is decidedly beneficial. Its use appears to shorten the period of acidosis.

BIBLIOGRAPHY

[1]Hedon, E.: La survie indefinie du chien depancreaté traité par l'insuline et les effets de l'interruption du traitment. Je. de physiol. et de path. gen. 25: (March) 1927.

[2]Joslin, Elliott P., Root, Howard F., White, Priscilla, Curtis, Stanley W., and Adams, H. D.: Diabetic coma. Med. Clin. No. Am., 13:3-32 (July) 1929.

[3]Bowen, Byron D. and Beck, Gilbert M.: A report of three cases of diabetic coma associated with acute nephritis. Bull. Buffalo Gen. Hosp. (April) 1925.

[4]John, Henry J.: Diabetic coma. Jour. Am. Med. Ass'n., 93:425-430 (August 10) 1929.

[5]Hartmann, Alexis F., and Darrow, Dan C.: Chemical changes in the body occurring as the result of certain diseases. III. The composition of the plasma in severe diabetic acidosis and the changes taking place during recovery. Journ. Clin. Invest., 6:257-276 (October) 1928.

"Arbitrary Period of Disability" As a Mode of Settlement in Compensation Claims

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Definition

THE period of disability as it is conceived in medico-legal terminology is that length of time during which an employee in any industry is unable adequately to perform any gainful work. The disability may be total such as might prevent the attendance of the employee at his place of occupation; or partial, disabling him from doing the usual amount or type of work per hour or day.

Besides these two, there are, of course, variations in the capacity of any worker that depend upon many other diurnal or intermittent factors; such as fatigue, general state of health, state of mind, et cetera. These, however, have no bearing on the compensation aspects. The gradation between these as well as between total and partial disability, and particularly the progress from partial disability to full capacity for work is almost always slow.

Arbitrary Period of Disability

It is therefore quite important to determine as nearly as possible the beginning and end of the periods of partial and of total disability. This is often difficult to do. From objective findings alone, it is not usually advisable to make a prognosis of the duration of disability. The subjective complaints of patients in these cases come into such important play that they make the determination quite indefinite. There may exist an independent disabling malady that overshadows the accidental illness and prolongs the patient's disability.

On this and other accounts, in a large number of cases requiring the consideration of these questions, it is of great assistance to apply a principle that may be called "an arbitrary period of disability." This must embrace the probable duration of all effects of the alleged accident, particularly in restrospect, after the patient has recovered from them. It must also take into account the patient's mental attitude, as well as that of the insurance carrier, toward the liability aspects of the case. The state of mind adumbrating the patient's physical condition frequently demands a summary settlement, if it is at all equitable. The confirmatory opinion of the patient's attending physician is of invaluable assistance in such settlement. Only then does the patient reconcile himself to the prospect of resuming his work.

The length of the arbitrary period of disability, i.e, the exact moment of its termination need not be decided

with precision. It often is satisfactory to the patient and the carrier if the period of disability, both partial and total, is considered to lie within a liberal time allowance. The application of this principle will be exemplified later in the consideration of particular cases.

Classification

The determination of an arbitrary period of disability as a help in the liability settlement of compensation claims is required particularly in certain types of cases. These may be listed as follows:

1. Where the disability depends on subjective complaints alone, as in cases of cerebral concussion, heart strain, and some other more obscure clinical conditions.
2. Where the objective findings have abated and the subjective complaints persist, as in cases of gas poisoning, lead poisoning, etc.
3. Where the question of temporary aggravation is plausible, although an underlying progressive condition exists; such as pulmonary tuberculosis, thromboangiitis obliterans, hyperthyroid states, organic heart disease, and other progressive conditions.
4. In slow healing injuries of the viscera, especially lung injuries.
5. In the milder forms of post-traumatic hysterias or traumatic neuroses.

Discussion of Cases

1. *Where the Disability is Essentially Only Subjective*—In the consideration of cases presenting very few or no objective signs, the credibility of the patient is an important factor in establishing the period of disability. The examining physician's impression is gained mainly from the medical history given by the patient—its consistency, the lack of exaggeration,—and from frank responses during the physical examination. In general, a judgment must be based on the underlying personality of the claimant, together with the essential conditions of his employment and his compensation claim.

Of course, cases of malingering, if diagnosed, are naturally dismissed from consideration. However, patients who exaggerate because of a natural tendency or because of their mental attitude to the particular accident still require the equitable adjustment of their compensation claims. In these cases, the application of an arbitrary period of disability will not be so liberal as in those cases where the symptoms have a definite organic basis.

The following case is an example of this group:

Erna G., 34 years old, fell down twelve steps of a stairway and regained consciousness after being removed to the medical department at the place of the accident. She had dull pain in the back of the head, but spent two weeks in the country without symptoms. The headaches persisted, recurring at times quite severely, with nervousness and hysterical crying and laughter. The patient gave a history of occasional headaches and bilious attacks which were present before the accident and were associated with hysterical manifestations. She complained, however, of insomnia and restlessness at night, palpitation at times, and slight loss of weight; but she worked steadily after her return from vacation.

Physical examination, 6 months after the accident, was negative except for a hysterical restlessness of her hands, biting of her fin-

ger-nails, inconstant digital tremor, and hyperactive tendon reflexes. The basal metabolic rate was normal.

Discussion.—A certain amount of cerebral concussion was conceded to have occurred at the time of the patient's accident. But the previous history in this case lays the background upon which we can interpret the nervous twitchings and hysterical manifestations that were noted in the physical examination and the post-accidental complaints. By the studies made in this case, we were able to exclude hyperthyroidism, cerebral disease, or other organic neurological changes that might otherwise be attributable to the accident.

We assumed that the accident aggravated the patient's prior nervous condition, exaggerating her subsequent symptoms. The effects of the accident were considered relatively temporary, and an arbitrary period of disability was satisfactorily applied in the settlement of this case.

2. *Where Subjective Complaints Persist.*—The general question in these cases follows the same line of argument as in the previous group. In these, however, full allowance for disability must be made for the period during which objective findings were positive. The arbitrary period follows only subsequently. His symptoms and complaints persist and his disability must be continued until it is obvious that no further disability can be attributed to the original accident. In these cases, when the patient returns to work, an allowance must be made in retrospect up to the time when his symptoms have completely subsided.

This is illustrated by the following case:

Sidney F., a young linotyper, 29 years of age, when he was examined by us complained of symptoms of plumbism of two years' duration. He began to have cramp-like abdominal pain associated with nausea, and a diarrheal stool almost daily on arising. For six months, he also felt weakness of his hands and wrists in working the linotype machie. He noticed increased pallor and became easily fatigued.

Examination showed a moderate degree of secondary anemia with slight variation in the shape and size of the corpuscles; but there was no granular basophilia. Some of the peripheral vessels were tortuous. The physical findings were otherwise negative.

Discussion.—The patient presented the early symptoms of plumbism. After a time spent away from his occupation, he was advised to undertake a less hazardous occupation for so young a man. His symptoms disappeared and an arbitrary period of disability was suggested and accepted in settlement of his claim.

3. *Where Temporary Aggravation Has Occurred of an Underlying Progressive Disease.*—These cases form by far the largest group amenable to settlement of their claim by the "arbitrary period of disability." Determining the amount of liability in cases of this character involves the consideration of certain general factors. These are:

a. The competency of the accident as a producing cause of the condition or disease in question.

b. Its competency as a cause of aggravation, if the disease pre-existed.

c. The length of time during which the effects of the alleged accident caused aggravation.
d. The effects of complications and sequelae of the accident.
e. The amount of total disability and of partial disability during that period.
f. The curability and termination of the underlying progressive disease or condition.

Some of these themes must often be decided quite arbitrarily.

The relationship between an accident and an ensuing disease may be considered only in a general way. When a grave accident is followed by a rapidly advancing and marked state of thyrotoxicosis, for instance, the two may be causally related. But even in such an instance, the fact of sequence does not absolutely prove causal relation. There may be simultaneous emotional or nervous disturbances, quite unrelated to the accident, that may have caused the thyroid condition. However the benefit of the doubt in such an instance can be given the patient, and the disability attributed to the accident. This does not, of course, apply in infectious conditions where the agent is bacterial and was not introduced by the accident.

The competency of an accident as a cause of aggravation is not easily determined. In most cases, some amount of aggravation may be allowed to an accident, even if there be only superimposed nervous effects. In the legal hearings of these cases, there is often introduced a great deal of quasi-medical terms which confuse the issue and allow only for an equivocal consideration of the cases. Such terms as "lowered resistance," "diminished vitality," and "shock" are used and elaborated upon at great length without any scientific conception and without any helpful value. In some cases, this question will require more ample discussion. These we shall take up under the various headings of the underlying conditions. The other factors to be considered are also best left for the various diseases where they will be more pertinently amplified.

Pre-existing Pulmonary Tuberculosis.—Medical opinion is apparently divided as to the possibility of accidental aggravation of pulmonary tuberculosis. One school holds that in order that the accident must bear a relationship to the pulmonary tuberculosis, the latter must be present in the region of the injury to the chest. Tuberculosis in the opposite lung, or even in a distant region in the same lung cannot be attributed to the accident unless some clinical correlation is apparent between the place of injury and the tuberculous focus. This holds true for either activation of a dormant process, or aggravation of an active lesion.

The other school believes that any physical shock or injury, either in the chest or elsewhere in the body, may and frequently does so disturb a latent or inactive focus of disease in the lungs that active tuberculosis ensues. It is by no means necessary that such an injury or blow should be on the chest itself. When the injury does occur to the chest, the likelihood of stirring up such an old latent condition is greater. The shock occasioned is transferred with almost the same de-

gree of violence to the opposite side of the lung as it is to the lung actually affected. Many instances of such contra-lateral lesions are on record, both in the chest and in the skull. They are technically known as the effect of "contre coup."

In both aspects of this subject, the time relationship between the accident and the clinical evidence is important. The effect of trauma is promptly evident in these cases. The symptoms develop within three months after the injury. If the symptoms of tuberculosis do not develop until after six months, there is no reason to suspect that the injury has any relationship to such tuberculosis. Some experts define the time limits even more closely, confining the accidental effects only within a period of two or three months.

Peter K., a man of 59 years, while lifting a heavy wooden door, felt a sudden sharp pain in the left mammary region with cutting sensation upwards. He became very pale and perspired profusely, but did not faint. The pain lessened in severity, but after resting fifteen minutes, he expectorated a small amount of fluid and slightly frothy blood. Slight blood-streaking of the sputum recurred a few weeks after the accident. There were no other developments but moderate cough and expectoration and considerable loss of weight.

Physical and roentgenographic examination showed extensive infiltration, fibrosis, partial consolidation, and small and large cavity formations throughout both upper lobes, more marked on the left side. There was pleural thickening, more marked on the left side. There was corresponding dulness and bronchial breathing and crepitant rales over the involved areas. The heart borders merged with the pulmonary dulness and therefore were not well-defined. The sputum showed the presence of tubercle bacilli. Besides, the patient had moderate arteriosclerosis and albuminuria.

Discussion.—From the history of slight hemoptysis immediately following the accident, and from the positive physical findings of advanced pulmonary tuberculosis, we may attribute the patient's pain following effort to the tearing of a capillary or of a pleural adhesion.

The claimant had a well advanced pulmonary tuberculosis that dated back, doubtless before the alleged injury. The only consideration that remains is of aggravation as a result of the exertion. It is probable that a temporary localized aggravation occurred, since the symptoms and disability started immediately at that time. However, the period over which such an aggravation is active can and must be determined entirely on an arbitrary basis.

We consider that about six months is a liberal time to allow for the effects of the aggravation in this case to subside. The condition otherwise, naturally, progresses uninfluenced with little prospect of cure. Under ideal conditions, of care, rest, good food, and fresh air such as may be obtained in a sanatorium, the tuberculosis may reach an arrested stage.

We therefore believe that an arbitrary period of six months' disability may be allowed as attributable to the aggravation produced by the alleged accident in this case.

Abraham G., a janitor 37 years old, lifted a barrel of ashes weighing 100 lbs. and immediately felt a sudden tearing or aching pain in the upper right chest, both in the front and back of the right shoulder. He coughed with increasing pain and the expectoration of a small amount of pink-

colored fluid blood. A few hours later, the patient expectorated a glass of fluid blood and small amounts for two weeks after. For the following six months, his only complaint was occasional with slight dry cough. For a time, the patient was observed in a sanatorium.

Physical examination of the lungs, six months after the accident, was negative. Radiographic examination showed evidence of pleural thickening in the left costophrenic sinus. There was marked fibrosis and accentuation of the vascular markings in the right base, and a few scattered shadows strongly suggesting a saccular type of bronchiectasis. There was some pleural thickening in the right interlobar fissure.

Discussion.—The findings pointed to a chronic indurative fibrous process involving chiefly the right base and a saccular bronchiectasis in the same region. There was no evidence of tuberculosis.

In this case, disability followed the sudden lifting of a barrel and was associated with pain in the upper right chest. It is well known that strain of the character described may increase the pulmonary and pleural tension so as to produce tearing of a capillary, or more likely of some pleural adhesion. It must be assumed that this is what occurred in the case.

For the period of hemoptysis and for the period of rest in the sanatorium that followed, the disability may be partially attributed to the alleged accident. Six months after the accident, the patient showed no further symptoms or signs that could bear any causal or aggravating relationship to the original accident.

The changes that were shown in the lungs by x-ray examination six months later were of old standing. They had probably taken years to develop and could, from their pathology, in no way be attributed to the strain of lifting.

Therefore an arbitrary period of disability had to be decided upon as an equitable consequence of the alleged accident.

Hemoptysis is only a symptom and in itself is no aggravating influence upon an existing pulmonary condition. This fact is not enough understood, particularly by the laity. The impressiveness of blood expectoration is so great to most people that they lay to it any subsequent aggravation of the underlying lung disease.

Hemoptysis is a common symptom also in chronic heart disease, particularly mitral stenosis, and its occurrence after strain does not indicate aggravation. Physical strain may cause rupture of a capillary in the congested lungs. But when that has subsided, the underlying disease remains in statu quo.

Therefore, it must be remembered that expectoration of blood is only a symptom, and does not usually initiate pathological changes in the lungs. It may cause disability insofar as treatment for hemoptysis usually consists of rest for a period of time. This time is generally employed to advantage in establishing a definite diagnosis.

The following case and, in a measure, the one that immediately precedes (Abraham G.) illustrate the importance of hemoptysis in the discussion of compensation claims.

Jacob S., an egg-candler, 45 years old, lifted a sixty pound case and expectorated some blood-streaked sputum that day and two days later, after occasional coughing. He had vague pain in the left submammary region and the back of the left chest, but

had no recurrent hemoptysis, no night sweats, and no loss of weight. He remained generally in good condition during a long period of observation.

Physical examination, including x-ray and sputum examination, were essentially negative except for fibroid changes at both bases and in the left second costal interspace.

Discussion.—Giving the patient credit for a relationship between the alleged strain of lifting and the blood-streaking of his sputum, this case presents no consideration of any prolonged disability, nor of any aggravation of a previously-existing condition. The patient expectorated some blood a few days after this strain, which necessitated his remaining at home for several days, under medical observation. That is the entire picture of disability that may be attributed to the accident.

Otherwise, the patient presented no evidence or any disability whatever in his cardiovascular or pulmonary condition. The occasional crepitant râles heard in the left apex region suggested the existence of a very incipient pulmonary lesion from which the blood might have originated. There was no other clinical evidence to show activity of this lesion, and we cannot assume any aggravation due to the hemoptysis. As we already stated, hemoptysis is only a symptom of a condition and does not in itself (if slight, as in this case) aggravate or precipitate any complications.

X-ray findings were entirely negative and two sputum examinations were equally negative. The heart condition was negative and the electrocardiogram was also negative.

We therefore expressed the conviction that the patient may be given the benefit of considering a causal relationship between the alleged strain of lifting and the subsequent expectoration of blood. Altogether, an arbitrary period of disability of three or four weeks would more than cover any consequences due to the alleged strain. The claimant was soon after the alleged accident able to resume his regular occupation.

After a long lapse of time following the first examination, the following new facts revealed themselves. Before the alleged accident, the claimant had some bronchial condition of uncertain diagnosis for which he was bronchoscoped. A pathological section was made into the mucous membrane of the bronchus on the left side, producing an open wound there. The alleged accident occurred two months later, with slight hemoptysis. The source of this can now be definitely localized to the bronchial wound, which was a vulnerable point in the lungs.

The above discussion therefore still stands fundamentally valid as to both the medical and compensation liability aspects in this case. We must therefore still assume the possibility of a relationship between the alleged strain of lifting and the blood streaking of the sputum that followed immediately after. However, the hemoptysis was of short duration, not abundant, and in itself did not produce disability. As soon as the first signs of blood-streaking subsided, the relationship to the alleged strain ceased.

Pre-Existing Heart Disease.—Pre-existing heart disease is often discov-

ered at the time complaint is made of symptoms developing during work. Cases of this kind form a very large group in which the amount of liability is extremely difficult to estimate. The relationship between the accident and the symptoms must remain speculative since often we do not know exactly what pathological changes were induced by sudden strenuous effort, or by direct injury. In these cases, the question of aggravation of a previously existent heart condition must be considered. Even without the history of accident, the patient's symptoms can often be fully accounted for by his previously existing disease. And these symptoms would eventually have developed without any accident .

Charles L., a young chauffeur aged 19, while lifting a package of 150 lb., felt sharp pain in the pit of the stomach which persisted. After a few hours of driving his truck, he began to feel shortness of breath and fatigue and frequent rapid paroxysmal palpitation with a sensation of fulness in the neck and left hypochondrium and precordial pain.

Physical examination two months later revealed the presence of long standing chronic rheumatic mitral stenosis and regurgitation and also chronic aortic regurgitation. These findings were confirmed by polygraphic, electrocardiographic, and x-ray studies. There was distinct precordial bulging. Tonsillectomy had been done some years before, although tonsillar remnants were still present.

Discussion.—The evidence of long-standing heart disease was very marked in this case. The patient had for years had chronic valvular rheumatic disease involving the mitral and aortic cusps for which, in all probability, tonsillectomy had been performed ten years before.

If the patient's assertion is to be fully credited, pain developed immediately following the alleged exertion. This, together with the other cardiac symptoms, would therefore be considered a temporary aggravation of his previously existing affection.

An arbitrary period of a few months to a maximum of a year may be allowed for such aggravation to subside. In this case, it appears to us that allowance of an arbitrary period of four months' disability is entirely equitable. Certainly, there was no evidence of any permanent organic alteration produced by the alleged accident.

Peter S., a stock clerk 59 years old, while supporting a crate weighing 800 lb. on the end of a truck, felt a sensation of discomfort and momentary sharp sticking pain in the precordial region. He continued his work, paying no further attention to this occurrence. That night, while walking home, he felt an unaccountable shortness of breath and a choking sensation. He felt dizzy and weak and had to sit down for rest. He continued his work for a week, despite these symptoms which continued and recurred on exertion. A week later, he took to his bed for the increased dyspnea and precordial pain. The patient resumed sedentary work, but found walking difficult on account of shortness of breath and occasional precordial discomfort.

The clinical examination and the special studies made in this case gave indisputable evidence of the existence of advanced arteriosclerosis with hypertension and myocardial disease. The blood pressure was 210/104. These findings were supplemented by the x-ray observation of an enlarged heart with dilatation and sclerosis of the aortic arch; pulsus alternans in the polygraphic tracings; and the abnormality of the *QRS* and *T* waves in the electrocardiogram, showing intra-ventricular block.

Discussion.—This entire picture existed before the accident as it was the

result of a long-standing and gradual process. The accident alleged comes into consideration in this condition only in having produced a momentary sensation of discomfort and sharp pain when the patient exerted himself in supporting a heavy crate. It is conceivable that this physical strain produced a natural increase in aortic pressure, super-imposing upon the previous pathological process a mechanical factor in the further distension of the aorta.

Characteristically, such an occurrence produces severe pain, usually of long duration, associated with immediate cardiovascular symptoms and relatively marked disability. In this case, the claimant resumed his work for perhaps two hours, avoiding the more strenuous efforts. The real symptoms which eventually produced the disability came on a few hours after the accident, while walking home that evening. At that time, he felt dyspnea, fluttering in the chest, dizziness, weakness, etc. His attempts at work after the accident aggravated his symptoms so that he found it necessary to avoid all exertion for a time.

Judging from the physical and special findings in this case, an eventual disability was not far distant. A period of perhaps six months under the best conditions of care might be allowed as an arbitrary period, after which the patient's disability would have occurred spontaneously. We may therefore conclude that the alleged accident in this case precipitated the disability to the extent of this length of time.

Antonio A., a longshoreman aged 47, had been working at his occupation without previous disability for twenty-seven years. Then one day, while unloading a ship, a heavy bale fell down on a hand truck. The handle of the truck struck the patient in the front of the left chest and knocked him down unconscious for five minutes. After a week in bed, he developed a burning sensation in the upper sternal region and sticking precordial pain. He felt sudden faintness with palpitation on walking and weakness which increased with exertion.

Physical examination 20 months after the accident showed enlargement of the heart. Over the aortic area, there was heard a loud, rough, blowing systolic and diastolic murmur transmitted to the vessels of the neck and down along the sternum. There was other evidence of aortic regurgitation, including water-hammer character of pulse and low diastolic blood pressure. Radiographic examination showed marked accentuation of the left ventricular curve and diffuse dilatation and sclerosis of the aortic arch. The Wassermann test of the blood showed a strongly positive (++++) reaction.

Discussion.—This patient suffered from aortic regurgitation and aortitis of the suprasigmoid portion of the aorta. The strongly positive Wassermann reaction indicated that syphilis was a causal factor in the production of the heart condition. The injury that the patient sustained, severe enough to have caused unconsciousness, may have contributed to aggravate the condition, causing the subsequent disability. According to the history that we obtained, the symptoms of disability ensued promptly after the accident. The disability in these cases is usually prolonged, the pain persisting and the symptoms often progressing.

In this case, of course, from the present available data, no arbitrary period of disability can as yet be established. After a length of time and repeated examinations, however, it will

be found that the patient's ability to work returns. At that time, in retrospect, an arbitrary period can be recognized.

Hyperthyroid Disease.—Thyroid disease may be found on examination some time after an alleged accident. The patient will often attribute his condition to the accident, although it may have, without his knowledge, pre-existed. In fact, this is the usual instance in such cases.

We find an underlying constitutional disposition, and the question to decide is the competency of the accident to precipitate hyperthyroid symptoms. It is well known that hyperthyroidism shows periods of spontaneous remissions or of aggravation. The intercurrent accident at any phase in these cycles must therefore be properly evaluated as an exciting factor.

Richard D. aged 26, a young fairly well-nourished plumber of nervous temperament, while lifting a sink weighing 250 lbs., suddenly felt rapid forceful palpitation. He had a feeling of exhaustion, nervousness, tremulousness throughout the body, tremor of the fingers and flushing of the face. He felt "winded", but continued at work for the day. After a day of rest, he returned to lighter work, but found even that produced palpitation, shortness of breath and mild localized precordial aching pain at times or an occasional attack of paroxysmal tachycardia.

Physical examination, two months later, showed considerable enlargement of the thyroid isthmus and both lobes. There was a suggestion of exophthalmos and fairly well-marked von Graefe sign. The heart action was rapid and regular, with a forceful impulse, systolic apical murmur and somewhat elevated systolic blood pressure. The basal metabolic rate was +33, indicating a definite increase over the normal metabolism, due to hyperthyroidism.

Discussion.—In short, the patient presented the cardinal symptoms and signs of exophthalmic goitre. He dated his illness, however, from the time of the alleged accident, and claimed compensation on the assumption of its accidental origin.

We may grant the possibility that the alleged exertion did produce a functional effect which brought the symptoms to the patient's attention. These would have eventually appeared with the progress of his condition. He did not suffer from the characteristic symptoms of heart strain and in our opinion did not develop any organic changes as a result of his exertion. So that at most, we may assume a temporary aggravation to have taken place. We have, of course, excluded acute intra-thyroid hemorrhages as a possible cause of the hyperthyroidism.

We therefore believe, in this case, that an arbitrary period of three months of disability may be allowed for the functional disturbances precipitated by the alleged accident. The subsequent symptoms must then be referred to the underlying thyroid condition as a result of which he may remain disabled for a long time.

Ethel M., a waitress 21 years old, dates her hyperthyroid symptoms from the time of an electric burn of her hand that she sustained while at work. She remained unconscious for a few minutes, and for two weeks after the accident, her legs felt stiff and numb. The right thumb and index finger were burnt and discolored, but healed after a month's treatment. After the accident, the patient began to feel a choking sensation in the throat, and the thyroid region swelled. The patient was nervous, easily flushed, had a tremulous feeling in the chest, digital tremor, and lost moderately in weight.

Physical examination, one year after the accident showed the thyroid isthmus and both lobes diffusely enlarged, the presence of a slight von Graefe sign, mild tachycardia, and slight digital tremor. The basal metabolic rate was normal.

Discussion.—It is well known that emotional stress contributes to the onset of, or aggravates a thyrotoxic condition. When, however, the accident is relatively mild and the thyroid condition almost a year later is also mild, such as was found in this case, one cannot reasonably attribute the hyperthyroidism to the alleged accident. In fact, causal relationship between the accident and the thyroid condition then becomes questionable. If we accept the details of the history and the long convalescence in bed from the slight burns of the fingers, we must assume some nervous shock to have taken place as a result of the accident. The symptoms may have had some element of origin in the alleged accident.

It may also be granted that the absolute disability, according to the history, lasted one or two months during which time the patient was confined at home under the care of her physician. The physical examination and study of the basal metabolic rate one year later showed only a very slight degree of hyperthyroidism. The symptoms were very mild and in no way disabling. The patient could resume her previous work without any difficulty.

The question still arises in such a case as to for how long a period the liability for compensation is imposabie. In the present case, the patient suffered no disabling condition one year after the alleged accident. We feel convinced that an arbitrary period of disability within the period of the year since the time of the accident should justly and fully compensate the patient for any effects that the electrical burn produced.

Francis J., a young truck driver, aged 22, fell from his overturning truck, injuring his right leg which had to be amputated below the knee after a week after infection. A month later, the bone stump was repaired under general anesthesia. Another month later, he was discharged quite well with no complaints or symptoms referable to the heart, lungs, gastro-intestinal, genito-urinary, or nervous symptoms.

Our physical examination five months after the accident was essentially negative, but for a moderate tachycardia of 96 per minute, moderate digital tremor, and a slight von Graefe ocular sign. The basal metabolic rate was +19, indicating slight hyperthyroidism.

Discussion.—The question arises as to whether the slight hyperthyroidism may have been produced or aggravated by the accident. That is entirely problematic. It is reasonable to assume, in this case, that hyperthyroidism developed following the emotional stress attendant upon such an accident as the patient suffered; and more particularly following the amputation of his leg.

As the patient's general condition was, however, good, it seemed to us that with only moderate care and with satisfactory nervous and mental control, he should improve and recover from this condition without any further consequences within a variable period of time. An arbitrary period of disability would therefore have to be determined at a later date, after re-examination of the patient.

Thrombo-angiitis Obliterans.—It is well known that the progress of thrombo-angiitis obliterans is gradual and its onset insidious. It consists of a progressive obliterative affection of the arteries and veins of the extremities occurring spontaneously. When the affected part is elevated it becomes very pale, and when it is lowered it becomes slowly congested; but in all instances, the peripheral circulation in these regions is very poor. Trophic changes, and finally gangrene, take place necessitating amputation. The condition is most commonly slowly progressive, often with periods in which the condition remains stationary for a long time; and it may even become compensated by intra-vascular canalization, or even healed.

As a result of direct injury to an extremity, intravascular damage may ensue; or periarteritis with hematoma and compression of the vessel from without. In either case, obliteration of its lumen may result with distal gangrene sometimes requiring amputation. In normal individuals an adequate amount of trauma will be necessary to produce this result and the condition remains non-progressive after the immediate sequelae have been dealt with.

In cases of thrombo-angiitis obliterans, we must assume that there is a greater vulnerability of the vessels and tissues of the extremities. Therefore, in cases in which the amount of trauma was slight, we must recognize the greater susceptibility of the injured parts. Secondly, the underlying disease persists and may progress even after the subsidence of the more direct effects of the injury. It is of primary importance, therefore, to determine how much of this progress of the underlying disease should be attributed to the accidental injury.

The following scientific beliefs may be laid down as the basic factors in determining the exact amount of aggravation by trauma in any particular case:

1. An injury cannot be assumed to be the cause of the condition of thrombo-angiitis obliterans (Buerger's disease) or of endarteritis obliterans (Winiwarter).

2. As an aggravating cause, it can only be of influence on the local involvement of the particular region injured.

3. It cannot aggravate the general process in the other extremities or elsewhere in the body, or at higher levels in the same extremity unless the phenomena following the injury point definitely to such aggravation.

4. If, after amputation, or after the local effects of the injury have subsided, the condition has remained stationary for a reasonable and acceptable length of time, the injury cannot be held liable for any subsequent developments. The acceptable, variable, though arbitrary, stationary period severs the injury and its effects from any relation to subsequent developments. It cannot be held that the injury may produce the unrelated and distant symptoms of the disease which may become manifest a long time after.

Harry B., a powerfully built man of 42, developed gangrene of the big and little toes of his right foot, a few days after a seven-pound iron fell upon it, across his shoe. These toes were amputated two months

later. The middle three toes remained normal. However, there was persistent pain in the stump scars and edema of the ankles after walking.

The patient was a Russian Jew and had been an inveterate and heavy smoker of tobacco. Physical examination, three weeks after the amputation, showed the existence of thromboangiitis obliterans. No pulsation was palpable in the dorsalis pedis and posterior tibial arteries of either foot. There was deficient superficial circulation in both feet. After two years of treatment, the condition was found to be not preceptibly progressive, having remained unchanged for a year.

Discussion.—From the history and the sequence of events in this case, we came to the conclusion that the cause of the gangrene was a traumatic thrombosis of the arcuate artery on the dorsum of the right foot. This resulted in partial obliteration at the locus of injury with complete closure of the terminal vessels to the big and little toes. There was a predisposing underlying thrombo-angiitis obliterans.

Certain of the etiologic factors that are usually associated with the development of thrombo-angiitis obliterans were present in the above case. The patient was a Jew of Russian antecedents who had smoked considerably and developed his condition within the usual period of incidence of this disease.

The injury produced a local aggravation of the pre-existing endarteritis with gangrene of two toes. There was no evidence, after a long period of observation, of any progress of the condition after the amputation of the toes. The circulation of the foot remained unchanged. There was no evidence of ascending involvement in the limbs which might be attributed to the accident. Incidentally, the process in the other limbs which was also present and was present at the time of the injury could not have been affected by it.

On the basis of the general principles above discussed, we believe that this case had reached a stage beyond the compensation limits for his injury; except for the loss of his two toes which remains a permanent defect.

Miscellaneous Progressive Conditions.—The same general principles apply to other long-standing conditions during which an industrial accident may occur and produce aggravating symptoms.

The following two cases of chronic disease illustrate the application of principles of arbitrary period of disability in settling compensation claims following intercurrent accident.

Sam S. aged 68, fell to the floor striking the front of his chest for which adhesive plaster strapping was applied. Two months later, he developed cough and expectoration and wheezing in the chest, with weakness, dyspnea on exertion, and some pain in the right lower thorax when he lifted a heavy weight.

Physical examination, eleven months after the accident, showed a marked chronic emphysema and bronchitis that long antedated the accident. X-ray of the lungs showed fibroid changes with calcification in both apices. There were indications of pleural thickening, slightly more marked on the right side.

Discussion.—There was evidence in this case of thickening of the pleura on the right side. There was, of course, abundant cause for this in the old extensive chronic bronchitis with pulmonary consolidation at the apices and chronic emphysema. These conditions had existed for years. Thick-

ening of the pleura is not a disabling condition. On the contrary, it is a healing process. At the time of the examination, the patient's respiratory symptoms of chronic bronchitis, wheezing in the chest, and some dyspnea were due to his old-standing condition and not to any pleural affection in the right chest.

However, the thickening of the pleura on the right side may have suffered some aggravation from the injury that the patient alleged to have occurred. We therefore believed that the compensation for the condition of the chest may arbitrarily be concluded within a period of a month, without the prospect of any further developments due to the accident.

Robert McK., a painter 34 years old, was holding a can of 50 pounds supported on his right shoulder, carrying it up a ladder. The weight swung him from the ladder, but by dint of his left hand-hold, he avoided falling. In twisting himself back to the ladder, he heard a "crack" in the right pectoral region with pain which radiated above the right shoulder. He continued work though the pain was slightly aggravated and prevented him from sleeping that night. After two weeks of rest, the pain gradually subsided.

Roëntgenographic exmination at that time showed irregular shadow localized near the base of the right lung, reaching out from the hilus region. But the peripheral portion of the right base was clear and the diaphragm was freely movable. Considered together with a four plus Wassermann reaction in the blood, the diagnosis was made of lues of the lung—probably an organizing gummatous exudate.

Discussion.—It is hard to see how the luetic condition in the lung in this case can be a result of the unusual twisting of the chest. However, from the symptoms of the sudden sensation of pain above the right shoulder with the occurrence of the accident, we must predicate the involvement of the lower pleural lesion. It is possible that a pleural adhesion existing there was torn away by the torsion. This is the most probable explanation which unifies the clinical picture in this case.

We may therefore say that the effect of the accident was transitory and the symptoms from it limited in duration. We should allow another month in the arbitrary period of disability for the duration of aggravation. The visible x-ray shadow may or may not have been initiated by the accident. It was probably an old process, and the adhesion that was hypothetically torn by the strain may have been part of this process.

4. *In Slow Healing Injuries of the Viscera.*—Healing processes in the injured viscera are generally slow and, by virtue of their position, cannot be observed accurately. The physical signs are no adequate indication of the progress; and the evidence of the x-ray, though important, is not complete. We must therefore depend, in a measure, upon the symptoms and discoverable signs as the sole basis for our opinion as to the patient's disability.

In the following case, the persistence of hemoptysis is an obvious and undeniable indication that the process in the lung has not entirely healed, following direct injury to the chest. But even without the hemoptysis and without further complaints on the part of the patient, we must allow an arbitrary period of disability for the healing process to have become completed, after the bleeding stopped.

The details of this case are as follows:

Paul R., a longshoreman 37 years old, was thrown twelve feet into the hold of a ship, fracturing three ribs. He has profuse expectoration of blood. He was treated by immobilization of the chest. Four months later, he still had slight cough and pain in the left chest in the region of the injury, and he continued to expectorate small amounts of blood clots after coughing.

Although the physical findings in the lungs were entirely negative, the occasional hemoptysis of which the patient complained must undoubtedly be attributed to the accident and the consequently injured lung tissue.

Discussion.—In this case, the persistence of symptomatic evidence, particularly hemoptysis, precludes any anticipatory decision as to how long will be the period of disability. However, when finally the hemoptysis subsides, an additional arbitrary period of disability must be allowed for completer healing of the lung tissue and for recuperation before the patient is declared able to work.

5. *In the Milder Post-Traumatic Hysterias.*—The determination of an arbitrary period of disability in these cases often has a salutary effect upon the mental attitude of the patient. The finality of such a mode of disposition sometimes cures the patient spectacularly, as occurs in the summary settlement of cases of post-traumatic neurosis.

In the following case, a claim was made on the assumption of permanent disability produced by fright. This, however, was dismissed and an equitable settlement was obtained by establishing an arbitrary period of disability.

Rella G., a chambermaid 32 years old, was frightened by a police dog jumping at her, his front paws on her shoulders, and barking at her. She had a headache that evening, but continued her regular work for three days, when she was released from work. A month later, she began to feel a choking sensation across her chest and slight shortness of breath on walking upstairs. She had a feeling of emptiness in the upper abdomen with anorexia. She also had sticking pains in the back and arms for a time. After a year, she still complained of occasional headaches and the vague symptoms narrated.

Careful physical examination and special examinations a year after the alleged accidental fright were entirely negative. The heart was normal in its mechanism, exercise tolerance, and all other tests. The reaction of the pupils, the peripheral vessels, and the activity of the thyroid gland were entirely negative. X-ray examination of the skull and lungs showed no organic changes. Other tests failed to indicate any disturbance in the anatomic (vagus) sympathetic or endocrine systems.

Discussion.—In this case, careful discussion with the patient revealed the influence of problems of an economic and emotional nature. Certain domestic difficulties were found which, judging from the time of the patient's complaints, were coincident or soon followed the accident. Inasmuch as no organic changes were found, and as a certain amount of disability might, in fairness, be attributed to the fright; a short arbitrary period of disability was decided upon as an equitable settlement of the claim.

Summary and Conclusions

1. The gradation between total and partial disability and between partial disability and full capacity to work is almost always slow.
2. In determining the liability in a large number of cases, it is of

great assistance to apply the principle that may be called "an arbitrary period of disability." This must embrace the probable duration of all effects of the alleged accident, particularly in retrospect.

3. Representative types of cases are given to illustrate the application of this mode of settlement.
4. The largest number of these cases comprises underlying progressive disease where the accident produced temporary aggravation.
5. Particular discussion is given to pre-existing pulmonary tuberculosis, chronic heart disease, thrombo-angiitis obliterans, and hyperthyroidism.
6. This mode of settlement is advocated as equitable in the types of cases classified above.

The Spastic Colon*

By Harry Gauss, M.D.
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SPASTIC colon is a functional disturbance of the colon, characterized by hypertonicity or spasticity of the colon, clinically by a variety of symptoms including abdominal consciousness, abdominal pain, constipation, flatulence, and a tendency toward introspection; while inflammatory changes may or may not be present.

The term spastic colitis has sometimes been applied to this entity, but objection has been raised to employing a term that signifies an inflammatory state, since the condition is primarily a disturbance in function, while the inflammatory reaction may occur in the course of the disease.

The essential mechanism of spastic colon is the hypertonicity. Several theories have been advanced to explain the causation of the hypertonicity. An unstable nervous system has been mentioned, a submerged fear complex acquired in early life has been held responsible, also an inherited spasmophilic tendency has been suggested. The direct etiologic factor is an open problem today, nevertheless it has been observed that usually the patient with spastic colon is a neurotic individual given to introspection, and that the hypertonicity of the colon is a local manifestation of a general spasmophilic tendency.

Since hypertonicity is the essential factor in the production of the symptomatology of spastic colon, an understanding of the factors that produce, or might produce it, become an essential preliminary to the rational treatment of the condition.

Hypertonicity of the colon results when the normal rhythm of the intestine becomes disturbed and the contraction waves are accentuated. The tissues involved in the mechanism of hypertonicity are the muscular layers of the colon and their innervations.

It is a truism in medicine that the bowels move by virtue of being bowels. This view is consistent with the broader view of biology that involuntary muscle fiber possesses the intrinsic property of rhythmical activity. The correctness of this view with reference to the intestine was first shown by the experimental studies of Bayliss and Starling who in 1899 showed by means of the enterograph, that when the gut is stimulated at a point, there results a contraction above the point of stimulation and relaxation below it. This wave of contraction passes down the intestine caudalward. This phenomenon takes place when all

*Read before the Medical Society of the City and County of Denver Feb. 18, 1930.

the nerves to the intestine from the central nervous system have been cut, hence this coordinated peristaltic wave is caused by a mechanism that exists within the intestine itself. This mechanism has been shown to be a peripheral nervous system lying within the wall of the intestine for the purpose of bringing about the necessary coordinated movements for the propulsion of the intestinal contents. This nervous system within the wall of the intestine is spoken of as a vegetative system in contradistinction to the sensori-motor system of the central nervous system.

The cells which cause the contraction waves are the nerve cells of the plexus of Auerbach. The presence of receptor nerves for this myenteric reflex has not been definitely established, but Ranson states that most physiologists assume the existence of sensory fibers in the gastrointestinal mucosa.

Hence in the consideration of the hypertonus of the colon, we bear in mind that there exists a vegetative nervous system within the wall of the intestine capable of causing contractions of the intestine, and that this system commonly receives its stimuli from the intestinal contents. Hence by inference it is assumed that hypertonicity may be initiated by material within the lumen of the intestine.

The intestine, however, has other nerve connections besides the vegetative system within its own walls. It receives connector fibers from the pelvic nerve which arises from the first, second and third sacral roots, and from the sympathetic branches of the superior mesenteric ganglion, the inferior mesenteric ganglion, and the pelvic ganglion; and through these the colon is placed in relayed contact with practically every part of the body including the psychic processes and the emotions. Indeed it is a common observation, that the emotions have a direct influence on the functions of the gastro-intestinal tract; although some persons react more readily than others, that is, in some persons the functions of the gastro-intestinal tract are more susceptible to influence by the emotions than in others.

That there exists a psychic tonus of the alimentary tract is generally accepted by physiologists. In 1911, Cannon discussed the existence of this psychic tonus of the intestinal tract. The literature contains numerous experimental studies in both man and animals supporting this view. Alvarez describes an instance where a tracing was being made of the intestinal movements of a man who had a fistula in the first portion of the duodenum. During the course of the record taking, there was a sudden increase in the tonus of the patient with a corresponding increase in the amplitude of the rhythmic contractions without any apparent cause for the sudden change from the previous rhythm. Directly the observer heard the steam table come rumbling down the hall bringing the patient's luncheon. The patient was hungry and had heard it first. In this instance, impressions coming in through the auditory and possibly the olfactory pathways had caused an accentuation of the tonus of the intestine. This is a concrete instance of the so-called psychic tonus.

Lebensohn has shown experimentally that "reflexes occur from the eye to

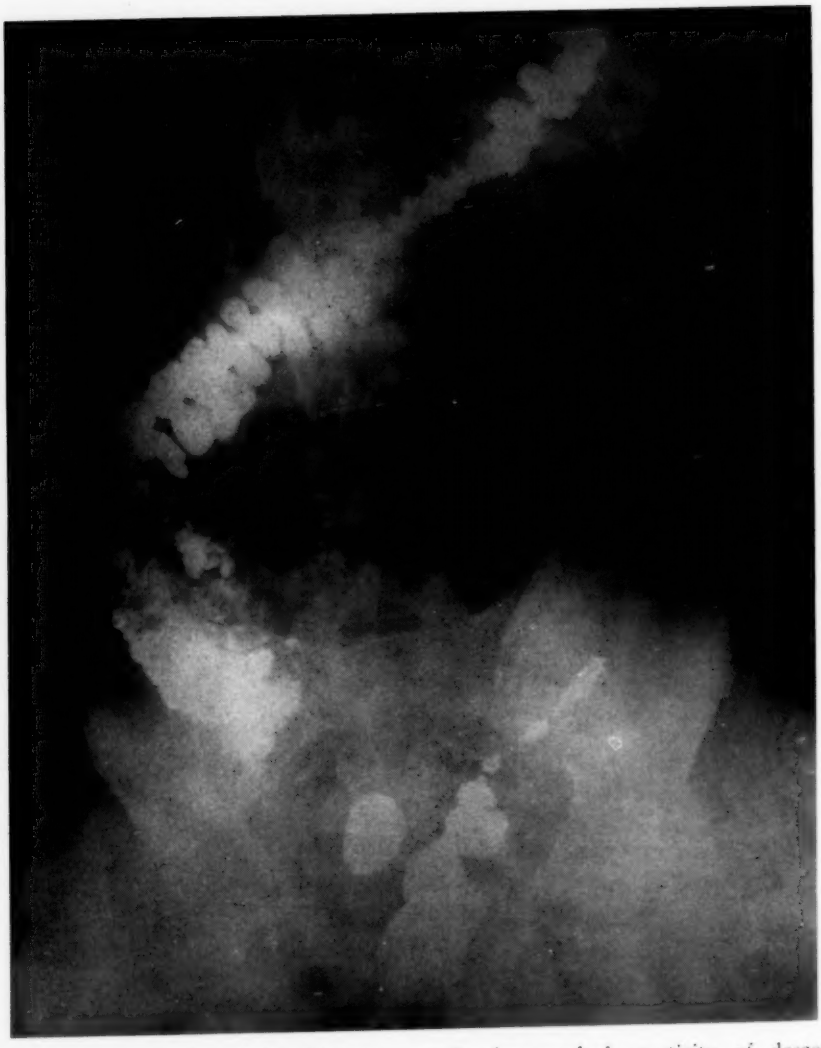

FIG. 1. 24-hour film of B. W., age 32, showing marked spasticity of descending colon.

the stomach, and from the stomach to the eye. . . . Using a stomach balloon connected with a water amnometer, tracings were made to demonstrate the effect of gastric motility of astigmatic errors and muscular imbalances artificially produced by wearing of cylinders and prisms, respectively. Errors of refraction or of muscular balance were definitely shown to exert a repressive effect on the motor functions of the stomach; while upon removal of such asthenopic irritants there was a release from inhibition."

Since there exists a psychic tonus of the gastro-intestinal tract, then by inference the psychic processes can produce a hypertonus of the gastro-intestinal tract. Hypertonus of the colon, then, can not only be produced by material within the lumen of the gut, but it can be produced by reactions elsewhere in the body including the emotions.

Dawson expresses the opinion that modern life makes trying and exacting demands upon the digestive system, and that there is a group of persons whose abdomens are overly sensitive to nerve impressions, and that in these people such reactions as fatigue, fear, anxiety, intensive application in any direction manifests itself in their hollow viscera. In some of them, the stomach may become irritable and hypertonic and may secrete an excess of acid; such patients develop the symptoms of gastric irritation. In others, the distal colon becomes irritable and hypertonic with a disturbance of its functions and they develop the symptoms of spastic colon. These patients are sometimes said to have "barometric abdomens," that is, their abdomens indicate the state of their emotional reactions. Oddly enough, the male "barometric abdomen" commonly reacts by the gastric irritation syndrome, while the female "barometric abdomen" reacts by the spastic colon syndrome.

Among the predisposing causes, sex then seems to have a significant influence. Spastic colon occurs three times as frequently in females as in males. Other predisposing factors are the chronic cathartic or enema habit, irregular habits of living especially that of ignoring the defecation reflex, faulty diet, fatigue, insufficient exercise, faulty environment, emotional strain, etc.

The commonest symptom is that of chronic constipation. The stools are unsatisfactory to the patient, they are infrequent, difficult to evacuate, small in caliber, sometimes flat in contour or resemble sheep-dung stools. Many patients give a history of employing cathartics, stating that they are unable to have a normal bowel function. At first they may have taken an occasional cathartic because of the failure of the bowels to function properly; then the frequency of the cathartic or enema was increased until it became a daily occurrence, and finally even the daily cathartic fails to cause satisfactory evacuations.

Abdominal consciousness is another common symptom in the patient with spastic colon. The healthy person gives little thought to his abdomen; except on occasions such as when he is hungry, and hunger pains attract his attention to his abdomen, occasionally other incidents as perhaps a distended bladder or colon may attract his atten-

tion, but in general, he gives little attention to his abdomen. The individual with spastic colon is abdominally conscious. His abdomen holds an important place in his daily thought-life. He is introspective and analytic of his abdominal symptoms, and in time his entire interest may center in his abdomen, and his world of interest lies within his bowels.

Abdominal distress and pain are quite likely to occur where there is already a centering of interest in the abdomen. All degrees of pain may occur, from an intensification of the abdominal consciousness to acute paroxysmal distress. Sometimes the distress may be present as a dull ache. It may be general or localized. Localized pain is probably caused by the area of spasm. This symptom commonly gives rise to error in diagnosis, since localized pain may be confused with pain coming from contiguous organs as the appendix and gall bladder.

Epigastric distress is sometimes encountered and occurs at variable periods after eating. Sometimes it will simulate the gastric ulcer pain, however, as a rule it is not difficult to differentiate them. Whereas the pain of peptic ulcer is sharply localized to a small circumscribed area commonly referred to as a "finger point" area, and it occurs in a definite place in the food cycle, the epigastric distress of spastic colon is distributed over a much wider area and may extend the entire zone between the costal margins and is variable in its appearance, it may occur after some meals but not after others, after some foods but not after others and on some days and not on others. The epigastric distress of spastic colon is not definitely periodic.

Many patients with spastic colon have had their appendices removed, after which they may feel better for a variable period of time when they have a recurrence of their symptoms. Eggleston states that in his series, twenty-two per cent of the patients had been subjected to appendectomy with little or no improvement, while five per cent had been subjected to cholecystectomy with no improvement, while Jordon and Kiefer report that twenty-three per cent of their patients with "irritable colon" had been subjected to appendectomy, and Bridges states that twenty-three per cent of his series of patients with chronic mucous colitis had been subjected to appendectomy with no demonstrable relief. There are undoubtedly instances where a differential diagnosis between appendicitis and disorders of the colon are difficult and a laparotomy may be justified; but Bettman strongly objects to appendectomy being performed on patients where the diagnosis is based on nothing more than "a history of indigestion and a poke in the right iliac region." Where a patient gives a history of a recurrence of the symptoms that were the indications for the appendectomy, disorders of the colon are to be considered including spastic colon. Elsewhere we have called attention to the frequency of appendectomy in patients with redundant colon.

Mucus in the stools is of frequent occurrence. The amount will vary greatly with the patient. There may be a few bits of mucus attached to the stool, or large quantities of mucus shreds or casts. Where the amount of

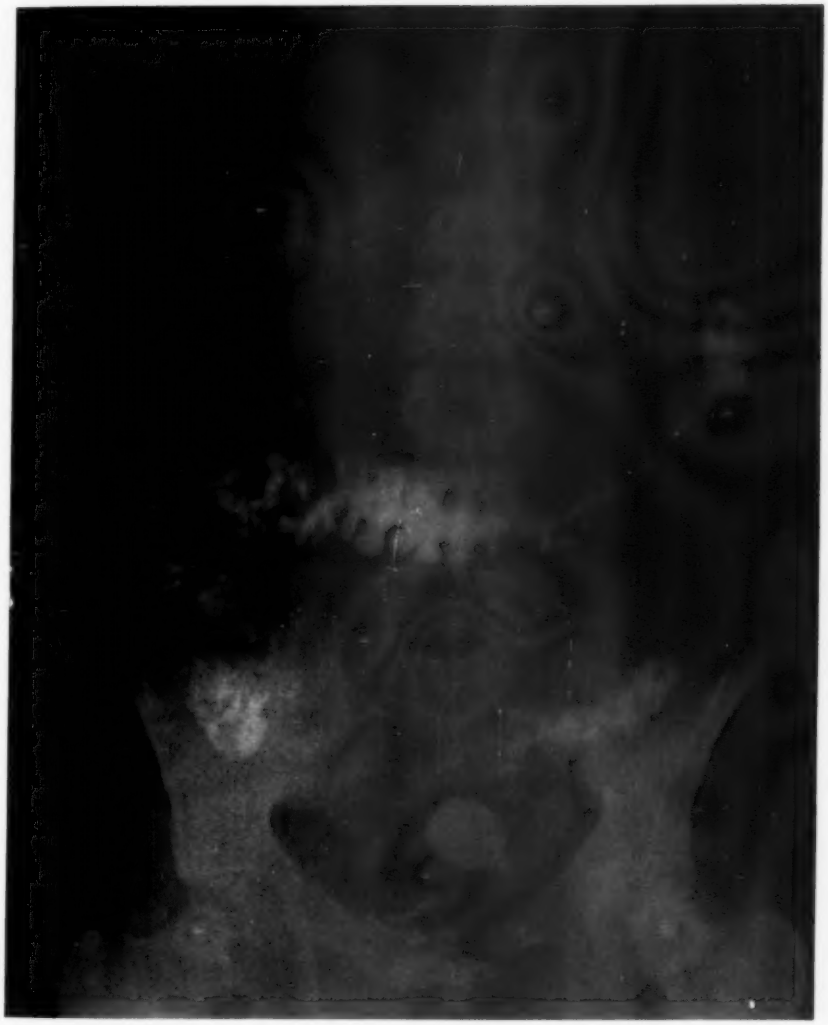

FIG. 2. 24-hour film of K. M., age 38, showing marked spasticity of distal half of the transverse and of the descending colon.

mucus is large, the condition is commonly spoken of as mucous colitis. There is a growing tendency to regard spastic colon and mucous colitis as the same clinical syndrome. Mucous colitis is regarded as an advanced form of spastic colon. Eggleston states that "I sometimes find it difficult to differentiate between mucous colitis and spastic colitis except by the amount of mucus observed in the examination of the stool. It is true that the patient suffering from mucous colitis frequently passes nothing but mucus, often in the form of molds or casts, usually following an attack of rather severe abdominal pain, but I would conclude that these are the more severe cases of spastic colitis and that the only difference between them is in the severity of the symptoms." Further relationship between spastic colon and mucous colitis is suggested by the similarity of their etiologic factors, since in both there is probably a disturbance in the equilibrium of the sympathetic and parasympathetic control of the colon, especially of the distal portion.

Flatulence and gas distress are commonly present, and are very annoying to the patient. This symptom is more likely to occur in the aggravated form of spastic colitis. It will be recalled that gases are normally liberated in the colon as the end product of digestion. These gases include carbon dioxide, hydrogen, nitrogen, methane, and to a lesser extent hydrogen sulphide. The absorbable gases such as carbon dioxide and to a lesser extent methane are absorbed into the circulation and excreted through the respired air, while the less absorbable gases as nitrogen, hydrogen, and hydrogen sulphide are passed through the rectum. About one liter of gas is passed normally through the rectum daily, while larger amounts are absorbed into the blood and so eliminated from the intestinal tract. In normal metabolism a person is little distressed by the passage of gases, but when the formation of gas is excessive or its excretion impaired, the patient experiences abdominal consciousness and later abdominal distress. Spastic colon may interfere with the elimination of gas in three ways: 1, by its spasticity, it diminishes the lumen of the gut and so reduces the amount of available absorbing surface for the gases; 2, spastic colon is a common cause of constipation, and the retained fecal masses occupying space within the lumen of the gut further diminish the available surface for absorption; 3, the spastic colon is an irritable colon and occasionally an inflamed colon, and as such probably has a diminished capacity for the absorption of gases.

Other symptoms encountered are chronic fatigue, chronic indigestion, underweight, nausea, vomiting, introspection, insomnia, mental depression.

Upon physical examination, the patient as a rule is not acutely ill, but gives evidences of emotional tension; he is introspective and self-analytical. A slight degree of secondary anemia may be present, the general nutrition is slightly below par, the tongue is coated and the breath may be offensive; the blood pressure is usually low. The heart and lungs give no information of importance with reference to the disease. Examination of the abdomen shows tenderness over the

colon. The pelvic colon is markedly spastic, ropelike, easily palpable and tender; the caecum, however, is seldom constricted and may be dilated; the transverse colon is the least tender part of the colon.

X-ray examination reveals either a general spasticity of the entire colon or of segmented portions of it. Usually the distal colon is involved. In some instances the haustral markings are lost, and the colon may present a "shoe string" appearance. Delayed emptying time of the colon is common, also an incontinent iliocaecal valve may be present and the caecum may be dilated.

Examination of the stool will indicate a diminished caliber of the stools, and mucus may be present.

Principles of treatment. In considering the principles of treatment of spastic colon, the following points come in for consideration

1. Spastic colon is a state of hypertonicity of the colon;

2. Spastic colon is a local manifestation of a highly irritable nervous system;

3. Hypertonicity of the colon can be initiated within the colon, or elsewhere in the body including the psychic processes;

4. The spastic colon is a constipated colon, and has acquired faulty habits;

5. The individual with spastic colon is usually a neurotic individual, and "the neurotic individual," says Jacobson, "has partly lost the natural habit or ability to relax";

6. The spastic colon is an irritable colon, and sometimes an inflamed colon.

From the foregoing premises, the following principles of treatment seem rational:

1. It is desirable to reduce the irritability of the colon;

2. Reduction of the irritability of the colon must be accompanied by a reduction of the general irritability of the central nervous system;

3. The colon having acquired faulty habits must be educated, or as the case may be, reeducated to function normally and periodically;

4. To accomplish these ends, the colon must be put into a state of rest or relaxation as far as it is physiologically possible to do so; and to accomplish this, the individual must be put into a state of rest or relaxation, after which the attempt is made to reeducate the colon to function normally.

In the treatment of spastic colon, the following therapeutic agents are available:

Bed rest. The value of bed rest is well recognized as a general therapeutic agent and is supported by clinical experience. Bed rest helps to put the entire human organism into a state of relaxation. It reduces the total amount of sensori-motor functions as well as the psychic processes of the body. It reduces the nutritional needs of the patient from that of the ambulatory patient which is 2,500 calories to that of the bed patient which is 1,500 calories, and thus facilitates the problem of putting the colon into a state of rest by permitting a reduction of the work imposed upon the gastrointestinal tract.

Diet. The control of the diet is an important factor in the management

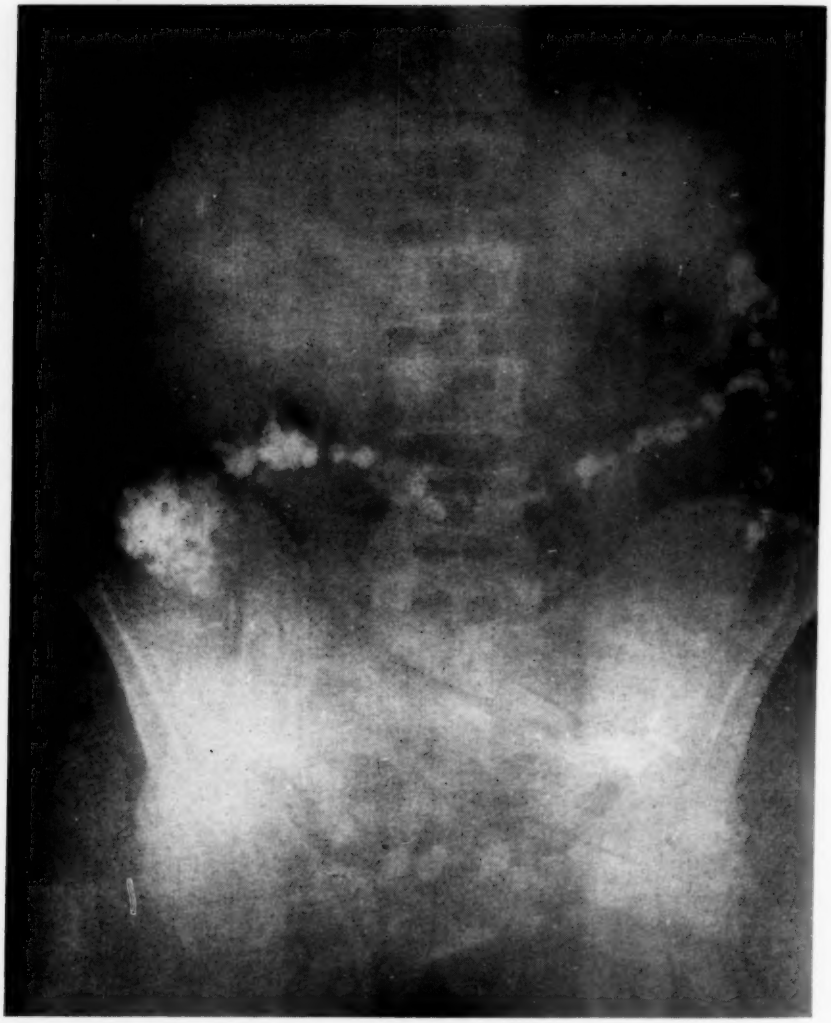

FIG. 3. 24-hour film of J. A. E., age 44, showing marked spasticity of the entire transverse and of the entire descending colon.

of spastic colon. Dietary indiscretions or an improperly balanced diet may have been a contributing factor in the causation of spastic colon; and once the hypertonus is initiated, ordinary food, or rather its end products can be the immediate stimulus for the maintenance of the hypertonicity. The first problem in the dietetic management is to put the colon into a state of rest. This is accomplished by the removal from the diet of all colon irritants. It will be recalled that the food elements which stimulate intestinal peristalsis are 1, roughage; 2, organic acids; 3, certain sugars. Foods which contain a high roughage content are bran, whole wheat, whole grain cereals, green vegetables as spinach, carrots, cabbage, asparagus, onions, tomatoes, parsnips, water cress, celery, turnips, beets, lettuce, legumes, as beans, peas, lentils, and nuts. Organic acids and sugars usually occur together in foods. They are found principally in the fruits as in figs, prunes, raisins, rhubarb, plums, grapes, apples, peaches, pears, raspberries, currants, strawberries, pineapple, orange. Lactic acid is a strong intestinal stimulant, and it occurs in certain foods without the presence of appreciable sugar as in buttermilk, sauer kraut, pickles and other fermented foods. These foods are removed from the diet and the patient is placed on a bland non-irritating diet made up to a caloric value of 1,500 calories and is chosen from those foods which contain little cellulose and a minimum of the organic acids. In this group of bland foods are the animal foods as milk, fish, eggs, the milk modifications as cheese, cocoa, chocolate, ice cream, the refined cereals as white rice, farina, mashed potatoes, blanc manges, broths, custards, butter, etc. Such a diet is a residue-free diet and contains insufficient roughage for the normal individual. However in the first stage of the treatment it is desirable to give to the colon the maximum degree of physiologic rest. However in order to avoid a stasis within the colon which would follow from such a diet, the diet is supplemented by intestinal lubricants. These intestinal lubricants facilitate the movements of the colon without irritating it; from their nature they are soothing in character and have an emolient action on the colonic mucosa. Two methods of intestinal lubrication are available; both are employed. The first is to ingest mineral oil by mouth, the usual dosage is one ounce per day; the other is the use of the oil retention enema, commonly given as two to four ounces into the rectum upon retiring. The patient is instructed to retain it if possible, and can usually do so without difficulty or discomfort. The residue-free diet in connection with the intestinal lubrication is continued for about one week. The exact time is determined by the progress of the patient, although one week is about the average. A diet, however, like other forms of therapy, must contemplate the progress and ultimate recovery of the patient and must be adjusted accordingly, so in the second week, roughage is added to the diet, beginning with a few articles and gradually increasing them to the diet. At first the pureed cooked vegetables are added, then the pureed cooked fruits, then the plain cooked fruits and vegetables, finally the raw

fruits and vegetables. The following is the sequence of the foodstuffs thus added: first, pureed cooked spinach, carrots, spinach, beets, then the plain cooked celery, lettuce, squash, pumpkin; then the pureed cooked fruits are added as pureed apple sauce, prunes, pears, etc. In the third week, the uncooked fruits and vegetables are added cautiously, as orange juice, then the whole fresh fruits and vegetables. As long as the patient is in bed, the caloric values of the diet remains that of the basic maintenance diet or 1,500 calories. The patient is usually kept in bed for about two weeks, and in the third week is allowed to engage in moderate exercise and at this time the diet is increased to about 2,500 calories to allow for the additional expenditure of energy.

Medication has a useful and important place in the treatment of spastic colon. Two groups of drugs are employed, the anti-spasmodics and the sedatives. Of the antispasmodics, belladonna and its derivatives is the drug of choice. Belladonna is employed because it releases the intestinal spasm. It is given until its purpose is achieved. However, it is difficult to gauge accurately the effect of the belladonna upon the colon, so some of the other properties of belladonna are looked for as the index of its action. It will be recalled that when the pharmacologic action of belladonna is reached, the pupils begin to dilate and the throat becomes dry. These signs are then looked for; and belladonna is commonly given as eight drops of the tincture three times a day until the pharmacologic action of the drug is observed in dilated pupils or the dryness of the throat; when it may be assumed that the drug has also acted on the intestinal musculature and released the spasm, after which the drug is discontinued or reduced in dosage. Patients exhibit marked variations in their response to belladonna, and the dosage is adjusted to their reactions.

A general sedative is commonly given in conjunction with the antispasmodic. Either the bromides or derivatives of barbituric acid as luminal are employed. The sedative is desirable because of the initial stimulating action of belladonna on the central nervous system; further it is desirable to depress all of the cerebral activities of the patient in the treatment of spastic colon in order to reduce the factors that produce the psychic tonus of the gastrointestinal tract. A simple procedure in the administration of both of these drugs is to give the usual dose of each of them until the patient complains of being drowsy or of inability to see clearly, when the drugs are then discontinued.

Local applications of heat to the abdomen have a soothing effect on the patient and help to divert his attention from his symptoms.

Foci of infection should be looked for, and if found, should be removed.

Usually in the third week of the treatment, the patient becomes ambulatory, and he is placed on a balanced diet which contains a moderate amount of roughage. He is instructed to take a moderate amount of exercise, and to continue the oil retention enemas at night. The belladonna may or may not be continued depending upon the reaction of the patient. The under-

lying neurosis may subside with the establishment of an agreeable routine for the patient, or it may require the attention of the neurologist.

The prognosis in spastic colon is always guarded. Due to the underlying neurosis, recurrences are apt to occur.

Summary

1. Spastic colon is a functional disturbance of the colon.

2. The etiology is thought to be an underlying instability of the nervous system.

3. It occurs commonly in women of the so-called "neurotic" type.

4. The essential mechanism of spastic colon is the hypertonicity .

5. Hypertonicity of the colon may be initiated locally by impulses originating in material lying within the lumen of the colon, or by impulses originating in other parts of the body including the psychic processes, when the impulses are thought to be relayed to the colon through the sympathetic nervous system.

6. The common symptoms of spastic colon are: constipation, abdominal consciousness, abdominal pain, flatulence, and a tendency towards introspection.

7. Neurotic individuals have partly lost the natural ability to relax.

8. Treatment aims to reduce the irritability of the hypertonicity.

9. The following therapeutic agents are available: bed rest, a bland non-irritating diet, intestinal lubrication, local anti-spasmodics especially atropine, general sedatives as bromides or the barbituric acid derivatives, local applications of hydrotherapy or physiotherapy to the abdomen, psychotherapy.

10. The prognosis is guarded.

References

Alvarez, W. C.: Ways in which Emotions can Affect the Digestive System, J. A. M. A., 1922, 92, 1231.

Bayliss, W. M. and Starling, E. H.: The Innervation of the Small Intestine, Proc. Physiol. Soc. London, 1898, p. 7.

Bettmen, H. W.: Chronic Appendicitis from the Viewpoint of an Internist, Annals of Internal Medicine, 1928, 2, 509.

Cannon, W. B.: The Importance of Tonus for the Movements of the Alimentary Canal. Arch. Int. Med., 1911, 8, 417.

Dawson, Lord.: The Colon and Colitis. British Med. Jour. 1921, 2, 31.

Eggleston, E. L.: Colitis, The Spastic Type. J. A. M. A. 1928, 91, 2049.

Gaskell, W. H.: The Involuntary Nervous System. Longmans, Green, and Co., London, 1920.

Gauss, Harry,: The Redundant Colon. Arch. Surg. 1927, 15, 560.

Jacobson, E.: Reduction of Nervous Irritability and Excitement by Progressive Relaxation. Trans. Sect. Nerv. and Mental Dis., Am. Med. Assn. 1920.

Jordon, Sara M. and Kiefer, E. D.: The Irritable Colon, J. A. M. A. 1929, 93. 592.

Kuntz, A.: The Autonomic Nervous System, Lea and Febiger, Phila. 1929.

Lebensohn, J. E.: Oculovisceral Reflexes. Am. Jour. Ophthal. 1929, 12, 562.

Ranson, S. W.: Afferent Paths for Visceral Reflexes. Physiol. Reviews, 1921, 1, 477.

The Intravenous Use of Epinephrine in Severe Bronchial Asthma

By I. S. Kahn, M.D., *San Antonio, Texas*

THE following case report suggests that is is possible to secure complete relief in the severest possible type of bronchial asthma that apparently offers nothing but a prompt fatal outcome, by the use of epinephrine in small doses given intravenously, after the administration of the drug in large quantities hypodermatically in the ordinary manner and after morphia given to the danger point have completely failed. In this case, and in two others of mine of the same type, the procedure was a life saving measure, and it is trusted that its adoption elsewhere in similar cases will prevent protracted suffering and possibly further fatalities during otherwise uncontrollable asthmatic paroxysms, relieving the utter helplessness of other medical attendants in similar situations. The dosages used were two and three minims of the 1:1,000 dilution, repeated every thirty to forty-five minutes. The usual disagreeable epinephrine symptoms of pallor, tremor, headache, nausea, and at times vomiting, appear almost instantaneously with this method of administration of the drug, especially with the three minim dose, but they are transitory, not severe, and were not objected to by my patients, and there were no other ill effects. I know of no reports in our medical literature advocating this line of treatment in what would otherwise be fatal asthma, hence this case report.

C. E., age 29, civil engineer, first seen in December, 1930, gave a history of severe intractable bronchial asthma of several years' duration, during which time his daily epinephrine ration at times for weeks on a stretch varied from three to eight cubic centimeters. During not infrequent exacerbations morphia was required in one-half grain and three-fourths grain doses every few hours. No morphia was required or used except during the periods of extreme severity. He had been unconscious during two previous attacks. A double Caldwell-Luc operation gave complete relief to the asthma for four months, but for several months past, the asthma had been daily and at times severe. Intranasal examinations a few days previous to the onset of the attack to be described, by two independent nasal specialists, revealed no indications for further surgery or for local nasal treatment. Severe asthma began about noon, December 31, 1929. Epinephrine hypodermatically in one c.c. doses every two hours at first gave a measure of relief, such relief becoming of briefer and briefer duration, and finally of minimal degree, lasting only a few moments. From midnight to noon of January 1, 1930, fifteen and a half c.c. of epinephrine were used, including two doses of two c.c. each one hour apart. In addition, morphia, three-fourths of a grain, was given at six a.m. and one grain at eleven a.m., all without the slightest relief. About one p.m., the patient became comatose, remaining so several hours. The pupils were pin point, with

respirations of twelve to fifteen per minute and a pulse of one hundred and forty to one hundred and fifty that was scarcely perceptible. As three-fourths grain morphia doses were not unusual in this patient, and none of the drug had been used for several days past, and as the patient had been unconscious previously from asthma when morphia had not been used in any such dosages, it is doubtful that this was altogether morphia overdosage, coma not being unheard of in mild asthma of this type. In spite of this heroic therapy, the asthma continued constant in severity, without the slightest remission. From two p.m. to five p.m. strychnia and caffeine sodium benzoate were administered. At 5:20 p.m., the patient was apparently moribund, sitting on the side of his bed held up by two attendants, totally unconscious, with extreme pallor, pulseless, unable to hold up his head, mouth wide open with saliva drooling—a most pitiful object—with the usual asthmatic respirations (fifteen per minute), easily audible in the adjoining room. Two minims of epinephrine were given intravenously without waiting for instrument sterilization. To the astonishment of all, there was some relief to the asthma and some general condition improvement. The following notes are taken from the nurse's chart.

6:00 p.m.	Epinephrine intravenously, 2 minims.	No more improvement, but recovering consciousness.
6:25 p.m	Epinephrine intravenously, 2 minims.	Brief nausea, conscious, some improvement.
7:05 p.m.	Epinephine intravenously, 3 minims.	Brief nausea and headache. Vomited once, followed by immediate decided improvement.
10:10 p.m.	Epinephrine intravenously, 3 minims.	Immediate headache. Vomited once.

This was followed in five minutes by such complete relief and relaxation that the patient was able to lie flat and sleep the balance of the night without further medication. Some five days later in a similar spell of almost equal severity, following the use of morphia, grain one-half, seven two to three minim intravenous dosages of epinephrine at similar intervals brought about the same complete relief after hypodermic administration had failed.

Since this last severe attack, by usual asthma treatment methods, it has been possible to hold this patient in comfort with from one to one and a half cubic centimeters of epinephrine hypodermatically in twenty-four hours, no morphia being required or used and same 6 weeks after the attacks above described, it was possible to omit epinephrine altogether.

From clinical observation, this patient seemed, among other factors, allergically speaking, hypersensitive to morphia in spite of his ability to use it in large doses. While this drug occasionally gave a certain amount of relief, and was usually used at the patient's request without the nausea and vomiting ordinarily seen in asthmatics sensitive to narcotics, such relief usually was only temporary, seemingly increasing the intractability of the subsequent asthma for many hours. His intradermal skin test to morphia gave a typical positive wheal and erythema, but this occurrence with morphia and other narcotics in the nonasthmatic is too common for this incident to be of clinical significance.

It is difficult to account for the failure of such large doses of epinephrine given hypodermically to give the slightest relief when such small doses are efficacious when given intravenously. It is hardly probable that constant repeated use of the drug in the upper

arms had altered the tissues so that absorption would not occur, as this point was taken into consideration and many of the doses used during this attack were given in the upper back and buttocks, never previously used for this purpose. It is more probable that with the enfeebled circulation accompanying the exhaustion of cases of this type, the rate of absorption of the epinephrine from the subcutaneous tissues into the blood stream is so slow as to permit its partial or total oxidation so that its distinctive action is not possible. This is, of course, remedied by intravenous administration. It is almost superfluous to add that the routine intravenous employment of epinephrine in paroxysms of bronchial asthma is unnecessary and not recommended. The writer has had no experience with intravenous doses larger than three minims.

Gastric Feeding As a New Treatment for Cardiospasm

By Moses Einhorn, M.D., *New York*

I DELAYED the announcement of my new treatment of cardiospasm for the purpose of convincing myself of its beneficial results. During the past few years, I have treated a number of patients suffering with cardiospasm, and a follow-up of the cases revealed that there had been no recurrences. Recently, I have had occasion to treat a few additional patients, with the most satisfactory results, and I am consequently presenting the treatment to the medical profession, in order that they may apply same to their individual practice.

Although I have made an extensive survey of the literature on cardiospasm, up to the present writing, I have failed to find mention or suggestion of the principles outlined in my treatment. It is true, that reference has been made to gastric feeding, but only in extreme cases of cardiospasm, where food necessarily had to be forced through a tube, into the stomach; however, to my knowledge, gastric feeding as a treatment for cardiospasm has not heretofore been advanced.

I shall not discuss here the cause or mechanism of cardiospasm, as I am discussing this phase in a separate article,[1] but I shall merely present the main principle involved in this treatment, namely, gastric feeding.

Gastric Feeding.

In gastric feeding, I use my new gastro-duodenal apparatus,[2] which consists of a special bucket and a marked tube (Fig. 1). The main characteristics of the bucket are its three part composition, its capsule shape, spiral arrangement, and its lower part three times heavier than the upper part.

The tube is of semi-soft quality, which lessens the possibility of knotting or bending, a usual occurrence in a dilated esophagus. It is marked with a single black line, 20 inches from the bucket, and with a double black line, 27 inches from the bucket. At the end of the tube a rubber stop-cock is introduced.

This gastro-duodenal apparatus, with its special bucket, is superior to any of the others now in use, for the following reasons:

1. Swallowing of the bucket is accelerated, because of its capsular shape and weight, which is sufficient to permit the passage of the tube through the esophagus with a minimum of discomfort to the patient.

2. Because of its weight (11 grams), being heavier than any other bucket now in use, it maintains its in-

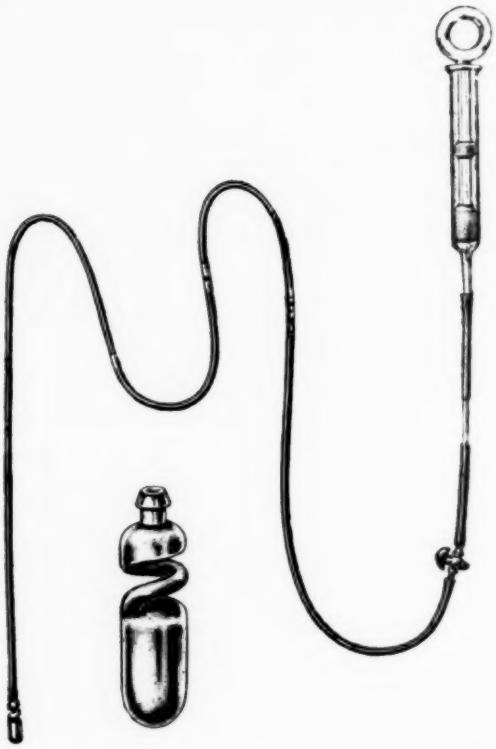

FIG. 1

tended course along the esophagus, which is usually dilated in cases of cardiospasm.

3. Its proper arrangement, the distal end made of solid metal, three times heavier than the upper part, causes the tube to be carried down to the lowest point of the esophagus, in the region of the cardiospasm.

4. Due to its weight, it overcomes the spasms at the cardia, and passes easily through the spasmotic area into the stomach.

5. No silk cord guide is necessary, as the bucket acts as a guide for the tube.

Method Employed.

The patient is placed in an upright position in bed or on a chair, and is instructed to open his mouth. The bucket, which is moistened and held between the thumb and forefinger, the middle finger being used as a base, is placed on the patient's tongue. He is then instructed to utter the sound Ah, and the tube is rapidly pushed into the esophagus. While concentrating on the act of swallowing, the bucket, due to its weight and capsular shape, is slowly carried through the esophagus into the stomach. The patient then continues to swallow the tube, until the first black mark, 20 inches from the bucket, is reached.

To ascertain whether or not the bucket has passed the spasmotic area and entered the stomach, the following test can be employed. Inject a small quantity of liquid through the tube with a syringe. The fact that the liquid can be withdrawn indicates that the bucket is still in the esophagus, above the spasmotic area, but if the liquid cannot be withdrawn, the bucket has already entered the stomach. The patient is now instructed to swallow the tube midway between the first and second mark, and a piece of adhesive tape is attached to the tube at this point.

After the tube has been correctly inserted, feeding may be commenced. The patient is fed with the aid of the tube for a period of ten days. In order to insure complete rest and relaxation, it is preferable that the patient remain in bed throughout the course of the treatment. However, the treatment may also be ambulatory, if necessary.

Every three days, preferably in the morning, on an empty stomach, the tube is removed for cleansing purposes. At first, same is removed only a few inches, and the saliva which has accumulated in the esophagus, above the spasmotic area, is withdrawn with a syringe. The esophagus is then thoroughly washed, by injecting a solution of boric acid or luke warm water through the tube. When this process has been repeated several times, the tube is removed, cleansed with warm water, and reinserted into the stomach, in the manner previously explained.

This new treatment of cardiospasm, which I have outlined, is particularly beneficial in cases of cardiospasm, not associated with any other organic gastrointestinal lesions. About ninety per cent of the group which I treated had simple cardiospasm, but no other obnormalities. Since, aside from this ailment, the cardiospasm patient is usually normal, he is able to partake of a variety of foods, providing these foods are prepared in liquid form, and can pass readily through the tube.

The feedings should be frequent, and in small quantities, not exceeding one and a half (1½) glasses every two or three hours. Sharp and spicy foods should be avoided; also, extremes in heat or cold. Water may be taken through the tube, between meals, and thirst and dryness of the mouth satisfied with the aid of a mouth-wash.

Diet.

Orange juice, grape juice, tea, cocoa, chocolate, coffee, milk, cream, mixture (¾ milk, ¼ cream) tea and milk, egg-nog, farina, vegetable soup, celery soup, asparagus soup, chicken soup, barley soup, gruel, beef juice, spinach (liquid form), jello (dilute), custard, apple sauce, fruit sauce.

Advantages.

1. Patient is free from the discomfort in the epigastric region, which usually accompanies cardiospasm.

2. Complete rest is offered to the spasmotic area, including the lower part of the esophagus.

3. The intake of food can be increased with the aid of the tube, and weight incidentally gained.

4. The physical and psychic rest obtained by this treatment indirectly has a beneficial effect on the cardiospasm.

5. The constant presence of the tube at the site of the spasmotic area tends to counteract the spasms.

6. Forcible dilation by special dilatory instruments is usually unnecessary.

Summary

Gastric feeding is advanced as a new principle in the treatment of cardiospasm. The apparatus used in this treatment consists of a special bucket, the lower part three times heavier than the upper parts. The treatment is usually given while the patient remains in bed, but, occasionally, may be ambulatory. The patient is fed through a tube, for a period of ten days, the diet including a variety of foods, in liquid form. The intake of food should be frequent, and in small quantities, not exceeding one and a half glasses every few hours. Sharp or spicy foods, as well as extreme hot or cold foods should be avoided.

[1]Einhorn, Moses: New Conception of the Mechanism of Cardiospasm (to be published).

[2]Einhorn, Moses: A New Tip for Gastroduodenal Tubes, J.A.M.A., 1926, Vol. 86, pp. 1615-1616.

Glycosuria and Recovery Following Methyl Salicylate Poisoning

By Elmer L. Sevringhaus, M.D. and Ovid O. Meyer, M.D., *Wisconsin General Hospital, University of Wisconsin, Madison, Wisconsin*

ACUTE intoxication with methyl salicylate is reported to have been fatal from a dose of one ounce. There have been recoveries following such doses and also deaths from smaller doses in children. The variable susceptibility to salicylic acid intoxication is likewise recognized. [1]The following case is of interest because of the recovery following a large dose, and because of the discovery of glycosuria as a feature of the intoxication.

A nurse, thinking she was taking an ounce of saturated solution of magnesium sulfate, took the same amount of synthetic methyl salicylate instead. This was at 8 a.m. She explained the error as due to her practice of holding her nostrils shut when taking a saline. Chagrinned at the mistake she said nothing at first, but later asked indirectly for advice in event of such an accident. She did not have the gastric lavage which an interne recommended. She felt well until five hours later when she vomited material which she said was oily and had a slight odor of methyl salicylate. Then vertigo and headache were noted. It was not until after fourteen hours that she sought medical care, with a "bursting headache," tinnitus aurae, almost complete deafness, nausea, and vertigo, and partial delirium.

When magnesium sulfate and castor oil were administered they were promptly vomited. The vomitus apparently contained no methyl salicylate. Two stools voided during the hours preceding examination had shown no gross blood. Blood pressure, temperature, pulse and respiratory rates were not unusual. The repeated emesis of all fluids given by mouth continued for about 24 hours. Due to dehydration, urine was not secured until the morning following the taking of the poison. At this time the urine was found to contain much sugar, acetone, 0.1% albumin, but no casts. The blood sugar was 148 mg. per 100 cc.

The patient felt well after five days. By the second day the glycosuria and ketonuria had disappeared, by the fifth day the albumin had vanished, and on the eighth day a sugar tolerance test was done. The original blood sugar level was 81 mg. per 100 cc. The maximum, 195 mg., was reached an hour after ingestion of 50 g. of dextrose. After three hours the blood sugar had dropped to 126 mg. The tolerance was evidently still a bit impaired. Two weeks later the same test

was made. The initial blood sugar value was 102 mg., the maximum of 125 mg. was reached in one-half hour, and the return to 92 mg. had been accomplished after two hours. Glycosuria did not accompany either test. Blood sugar determined before breakfast six months later was 78 mg. per 100 cc. The urine at that time was free from sugar, acetone, and albumin. The nurse had been well and on regular duty throughout the interval.

It is evident that there was in this case a temporary and presumably perfectly recoverable injury to the kidneys and the carbohydrate metabolizing mechanism, as well as to the central nervous system. The renal and nervous system injury have been recognized in the cases already reported in the literature, which is cited by Pincus and Handley[2] and by Woodbury and Nicholls.[3] Disturbance of carbohydrate metabolism has not received attention. Ketosis has been mentioned by these authors but no significance was attached to it. Pincus and Handley[2] made detailed examination of the blood of one case, and found blood sugar 145 mg. per 100 cc. This was taken at the onset of convulsions, following which elevation of the blood sugar is known to occur. The absence of other known reason for hyperglycemia, glycosuria, and a disturbance of sugar tolerance in this case leads us to suggest that these phenomena indicate direct toxic action of the methyl salicylate. The site of injury cannot be specified.

[1] Peterson, F., Haines, W. S., and Webster, R. W.: "Legal Medicine and Toxicology," 2nd Ed., Phil., 1923, v. 2, p. 717.

[2] Pincus, J. B., and Handley, H. E.: Bull. Johns Hop. Hosp., v. 41, p. 163, 1927.

[3] Woodbury, F. V. and Nicholls, A. G.: Can. Med. Ass'n. J., v. 18, p. 169, 1928.

Experience With the Colloidal Silver Treatment of Cancer*

By William S. Stone, M. D., George T. Pack, M.D., and Helen Q. Woodard, Ph.D. *From the Memorial Hospital, New York City*

At the time of initiation of the lead treatment of cancer by Blair Bell it was claimed[1] that lead acted as a specific poison for undifferentiated tissues, whether embryonal or neoplastic. Colloidal lead was used in preference to ionic lead because of its lower toxicity, not because any beneficial action was anticipated from the colloid as such. Later work has shown that lead is deposited more freely in the liver, bones, spleen and kidneys than in the tumor;[2] that therapeutic doses do not necessarily induce abortion;[3] and that the highly embryonal chorionic epithelioma is not conspicuously lead sensitive.[4] The opinion has therefore repeatedly been expressed, and is summarized in the Report on the International Conference on Cancer, London, 1928, that the occasional beneficial effects observed after the treatment of cancer with colloidal lead are not due to any specific action of the lead on the tumor cells, but are due either to the action of lead as a general tissue poison or to the action of the colloid in producing some type of systemic shock.

The present work was based on the hypothesis that the action of colloidal lead was due to its effect as a foreign colloid. If this were true, then other colloids might be found which would have the beneficial action of colloidal lead without the high toxicity which constitutes so serious an obstacle to its use. As silver is toxic only in massive or long-continued doses[5,6] the therapeutic effects of colloidal silver in the treatment of cancer seemed worthy of investigation.

Considerable experimental work on the effect of intravenous injections of silver colloids has been reported in the literature.[7,8,9] Most of the preparations used contained organic colloids as protecting agents, so that it is difficult or impossible to determine whether the constitutional effects observed were due to the silver or to the protecting colloid. Hence it was decided in the present work to use unprotected colloidal silver, both for the sake of securing clear-cut results, and in order to avoid the danger of shock. It was felt that these advantages would outweigh the disadvantages of using material as dilute as the unprotected colloid.

The method of the preparation of colloidal silver was essentially the same as for the preparation of colloidal lead.[10] It consisted of main-

*This work was aided by a grant from the Littauer Fund.

taining an arc between silver electrodes immersed in a suitable solution. The solution was protected from dust and from carbon dioxide, and was maintained at a temperature of 15°-35° C. by means of an ice bath. The solution used was dilute sodium carbonate (.0015 molar). This was chosen because it was non-toxic, and was an efficient stabilizing agent for colloidal silver. As arcing proceeded in this solution the concentration of colloidal silver rose to a maximum and then, upon further arcing, fell to zero. As the stability of the colloid was somewhat less when arcing was continued past the maximum of concentration, the arcing was discontinued just before the maximum was reached. The colloid was then centrifuged for five minutes with a force of 1000 x gravity, sampled for analysis, closed with rubber seals, and kept for use.

Colloidal silver so prepared contained about .030% silver, of which about one-tenth was ionic, and the remainder was colloidal. It was dark bluish-brown to black in color. It was stable for at least a year at room temperature. It was coagulable by boiling, and hence could not be sterilized by heat. For this reason preparations intended for clinical use were made up with sterile precautions. Tests on glucose broth and agar with 72 hours' incubation showed these sols to be sterile. They also had considerable bactericidal action on a virulent strain of staphylococcus aureus.

The preparation was tested by intravenous injection in three rabbits before being used for humans. Single injections up to 5 mg. silver per kilogram body weight were made. The largest total amount of silver used was 22 mg. per kg. administered in eight injections over a period of 60 days. In no case was any reaction observed after an injection; none of the animals lost weight during the treatment; there was no significant change in hemoglobin or red cell count; significant rise in white cell count occurred after only one of seven injections when it was determined. In one animal the blood sugar was determined before and after four injections, and was not found to change significantly. Subcutaneous injections of ½-1.0 cc. of colloidal silver in the ears of these animals did not produce inflammation or necrosis, the silver remaining visible as a black deposit beneath the skin. Two of the animals were killed and examined postmortem. Gross and microscopic examination revealed no abnormalities beyond slight congestion of liver and spleen.

On the basis of this work on animals it was concluded that the toxicity of the colloidal silver used was low enough to warrant its employment in human subjects. The cases selected for this treatment were so far advanced that it was reasonable to conclude that no other form of therapy would be beneficial. In two cases the silver injections had been preceded by two cycles of x-ray treatment without any appreciable benefit.

Although the toxicity of the silver appeared to be much less than that of lead, it was necessary, however, to limit the amount injected because of the primary systemic reactions.

In this connection it would be well to note that Weil[12] in 1913, employed colloidal copper intravenously for the

treatment of cancer at the Memorial Hospital. The colloidal copper was given intravenously every day or every other day in doses up to 21 milligrams and total amounts up to 450 milligrams. The treatment was followed by slight fever, chills, nausea, loss of weight, and occasional albuminuria. In two instances, copper was found in the livers but not in the tumors. There was occasional subjective improvement but never a decrease in the size of the cancer.

CASE REPORTS

Case Report No. 1. A. V., a married Cuban woman, aged 44, applied to the Memoral Hospital on Dec. 19, 1928, complaining of a recurrent tumor of her right breast. The onset of menstruation was at 13½ years. Menses were normal until Oct. 1928, when she began to have menorrhagia of 15 days duration. She had one child, aged 26 years; this child nursed both breasts equally for one year.

Three years before application to this hospital, i.e., in 1925 she first noticed a lump in the upper portion of the right breast. In 1926, a mastectomy was done at another hospital. In April, 1928, she developed pleurisy with effusion on the right side; she had four pleurocenteses. In May, 1928, a recurrent tumor mass appeared in the scar of the previous operation. She has had considerable dyspnea.

She was in good general condition and weighed within two pounds of her maximal weight. Examination of the lungs showed a broad zone of dullness to flatness and decreased to absent breath sounds at the right base. The liver was not palpable. On the right anterior chest wall was a bulky, lobulated, fungating tumor, 10 centimeters wide. It was fixed to the chest wall. In the lateral portion of the scar was another nodule and in the chest wall below the scar and in the

Intravenous injections of colloidal silver solution:

12-27-1928.—27 milligrams of colloidal silver in 77 cc .of solution.
1- 2-1929.—25.4 milligrams of colloidal silver in 82 cc. of solution.
2- 4-1929.—32 milligrams of colloidal silver in 130 cc. of solution.
7-31-1929.—16 milligrams of colloidal silver in 65 cc. of solution.

Laboratory Examinations:—

Blood Counts	*Hb.*	*R.B.C.*	*W.B.C.*	*Neut.*	*Large Lym.*	*Small Lym.*	*Bas.*	*Eos.*	*Trans. Cells*	
12-27-1928	65	3,460,000	11,800	72	5	15	1	—	7	
1- 2-1929	65	3,400,000	12,200	71	4	20	—	3	2	Polychromato-
1-16-1929	65	3,510,000	9,300	76	7	14	—	—	3	" philia
2- 4-1929	70	3,300,000	8,840	70	7	20	1	1	1	
2- 7-1929	70	3,480,000	11,800	77	5	16	—	—	2	
2-25-1929	70	3,648,000	8,600	80	6	14	—	—	—	
7-31-1929	55	2,850,000	7,400	77	1	18	—	2	2	" "

12-27-1928 Blood sugar 86 mg 2¼ hours after injection
12-27-1928 Blood sugar 87 mg before injection. Blood urea nitrogen 9.3 mgs. per 100 cc. of blood.
12-31-1928 Blood urea nitrogen—10.6 milligrams
1- 2-1929 Blood sugar—79 milligrams. Before injection.
1- 3-1929 Blood sugar—89 milligrams 24 hours after injection.
1- 5-1929 Blood sugar—86 milligrams
1-17-1929 Blood urea nitrogen—12.1 milligrams
2- 5-1929 Blood urea nitrogen—8.8 milligrams
2-14-1929 Blood urea nitrogen—10.2 milligrams

Urinalaysss. Traces of albumin on 12-28-1928, 12-29-1928, 12-31-1928, 1-3-1929. 2-5-1929, 2-6-1929, 2-8-1929, 7-30-1929.

intercostal spaces could be felt numerous hard, immovable nodules. A radiograph of the chest was reported by Dr. Herendeen as showing extensive metastases in the right base, with thickened pleura, fluid and involvement of the lung parenchyma.

Course.—Within 30 minutes after each injection the patient had a chill lasting an hour or more; within three hours after injection her temperature rose to 103°F. In three instances there was nausea and vomiting shortly after the injection. The patient stated she felt better after each treatment, but no objective improvements were discerned. In March, 1929, there were vertebral metastases. In May, 1929, her liver was greatly enlarged and nodular and there was bilateral hydrothorax. On July 30, 1929, — 650 cc. of sanguineous fluid were withdrawn from the right pleural cavity. In July, she menstruated three times for seven days each. She died on August 3, 1929. A necropsy was performed; the anatomical diagnoses were:—

(1) Recurrent carcinoma of the right breast with metastases to left breast, left axilla, pleura, lungs, bronchial lymph nodes, both adrenal glands and bone.
(2) Right hemothorax with atelectasis of the right lung.
(3) Congenital anomaly of duodenum and gall-bladder.
(4) Bilateral papillary tumors of ovaries.
(5) Subserous fibroid tumor of uterus.

On microscopical study, the breast cancer was a cellular adenocarcinoma.

Intravenous administration of colloidal silver solution.
12- 1-1928—17 milligrams of colloidal silver in 93 cc. of solution.
12- 7-1928— 9 milligrams of colloidal silver in 41 cc. of solution.
2-25-1929—30 milligrams of colloidal silver in 110 cc. of solution.

Laboratory Examinations:—
12- 6-1928—Gastric analysis—No free hydrochloric acid. 2½cc. total acidity.
—Gastric contents contained many groups of large hyperchromatic cells, probably cancer cells.

Blood Counts	*Hb.*	*R.B.C.*	*W.B.C.*	*Poly Neut.*	*Large Lym.*	*Small Lym.*	*Trans. Cells*	*Eos.*	*Bas.*	
11-21-1928	75	3,640,000	13,200	56	7	27	5	3	2	
11-30-1928	80	4,000,000	9,400	74	7	13	1	4	1	
12- 4-1928	75	3,800,000	13,600	83	4	11	1	1	occasional stippled cell	
12- 6-1928	78	3,920,000	12,200	77	13	4	6			
12- 8-1928	75	3,800,000	11,600	74	2	20	3	1	1	stippled cell
12-27-1928	70	3,600,000	11,000	68	7	20	2	3		
2-25-1929	80	4,200,000	14,600	85	4	11	—	—	—	

12- 4-1928 Blood urea nitrogen—11.3 milligrams per 100 cc. of blood.
12- 8-1928 Blood sugar—42.8 milligrams per 100 cc. of blood.
12-10-1928 Blood urea nitrogen—10.2 milligrams per 100 cc. of blood.
2-25-1929 Blood sugar—167 milligrams per 100 cc. of blood. (before injection)
2-26-1929 Blood sugar—173 milligrams per 100 cc. of blood. (24 hours after injection)

Urinalyses.—Numerous analyses over four months time were normal except for two instances of traces of albumin, on Dec. 4 and Dec. 10, 1928.

The ovarian tumors were simple benign papillary adenomas.

Case Report No. 2. I. L., a Russian Jewish tailor, aged 50 years, was admitted to the Memorial Hospital on Nov. 21, 1928, with the complaint of severe indigestion of six months duration. His symptoms were;—anorexia, gaseous eructations, nausea and vomiting of increasing frequency, constipation, progressive asthenia, profuse nocturnal perspiration, indefinite visual disturbances, heaviness in epigastrium, loss of seven pounds in weight, hematemesis once and melena once.

The patient was an anemic middle-aged Jew. The lungs and heart were normal to physical examination. The only positive finding was a resistance and a sense of fullness in the epigastrium. The liver was not palpable. After a barium feeding, a radiograph of the stomach revealed an extensive carcinoma of the gastric fundus involving both curvatures; no retention was found in the six hour firm.

Course.—After the first injection of colloidal silver, he had a slight chill followed by a fever of 101°F., and vomiting. His appetite improved and after the second treatment his weight had increased by 17 pounds; his red blood count was higher than at any previous time. This improvement was transient. Later radiographs demonstrated that the carcinoma had increased in size to involve three-fourths of the fundus. The patient died on June 25, 1929.

Case Report No. 3. C. S., a white widow, aged 52 years, was admitted on Dec. 21, 1928, complaining of backache, urinary distress and sanguineous vaginal discharge. She had one adult child. Her menopause was at age 40. Two years prior to her visit, she first observed an occasional "spotting" of blood. In Sept., 1928, she had a severe uterine hemorrhage lasting one week, followed by a constant bloody purulent discharge. She had some difficulty in starting the urinary stream during the two weeks prior to her application. For one year, she experienced a severe sacral backache. She had lost no weight.

The patient was an anemic middle-aged Irish woman. The heart and lungs were normal to physical examination. The liver margin extended one finger breadth below

Intravenous administration of colloidal silver solution.
12-19-1928—22 milligrams of colloidal silver in 85 cc. of solution.
12-24-1928—20 milligrams of colloidal silver in 82 cc. of solution.

Laboratory Examinations:—

Blood Counts	*Hb.*	*R.B.C.*	*W.B.C.*	*Neut.*	*Large Lym.*	*Small Lym.*	*Trans. Cells*	*Eos.*	*Bas.*	*Fragile*
12-18-1928	75	3,600,000	11,900	79	3	11	—	4	1	3
12-24-1928	60	2,920,000	9,400	88	4	3	3	—	2	—
12-26-1928	75	3,940,000	11,000	83	2	12	2	1	—	—

12-19-1928 Blood sugar—99 milligrams per 100 cc. of blood (before injection of silver)
Blood urea nitrogen—8.5 milligrams per 100 cc. of blood (before injection of silver)
12-19-1928 Blood sugar 90 milligrams six hours after injection.
12-20-1928 Blood sugar 93 milligrams per 100 cc. of blood 30 hours after injection.
12-26-1928 Blood urea nitrogen—12.2 milligrams per 100 cc. of blood.
12-24-1928 Blood sugar 95 milligrams per 100 cc. of blood before injection.
Blood sugar 95 milligrams per 100 cc. of blood 2 hours after injection.
12-27-1928 Blood urea nitrogen 12.1 milligrams per 100 cc. of blood.
12-29-1928 Blood sugar 90 milligrams per 100 cc. of blood.

Urinalyses:—Albuminuria was practically constant, but slight in amount.

the costal margin. The cervix uteri was barely palpable; it was entirely replaced by diffusely growing carcinoma. The entire pelvis seemed to be infiltrated with cancer tissue producing the condition known as "frozen pelvis". By rectal digital examination, densely immovable parametrial infiltrations were palpated.

Course.—After each injection of colloidal silver, she had a slight chill followed by a fever of 102°F. No improvement was observed. The uterine bleeding increased in amount; she became progressively more anemic and weaker. She died on January 18, 1929.

Case Report No. 4. L. D., a married woman, aged 46, had her left breast removed for cancer at the Brooklyn Hospital in January, 1929. On admission to the Memorial Hospital, April 15, 1929, recurrent tumor masses were found in the operative scar and in the left axilla. There were also hard palpable lymph nodes in the left supraclavicular space and left cervical region. There was definite tenderness over the lower three ribs in the right mid-axillary line. Radiographs on April 15, 1929, and June 24, 1929, were reported by Dr. Herendeen as showing evidence of metastasis to spine, chest and pelvis with extensive bone involvement. The diagnosis was recurrent inoperable carcinoma of left breast with widespread metastases.

In April, 1929, the left chest anteriorly and posteriorly were treated by low voltage x-rays and the supraclavicular spaces and axillae were treated by high voltage X-rays. In July, two high voltage X-ray treatments were given to the pelvis posteriorly.

Course.—There was no beneficial influence in the course of the disease. The skin metastases became numerous. The liver became greatly enlarged and nodular, extending to the costal margin. In December, 1929, a pathological fracture of the neck of the left femur occurred. The patient became emaciated. The red blood count increased slightly.

Case Report No. 5. A. B., an Irish widow, aged 58 years, was admitted to the Memorial Hospital on Oct. 26, 1926, for prophylactic X-ray treatment following left radical mastectomy. She had eight children, none of whom had nursed the left breast because of a retracted nipple. In May, 1929, she first felt a lump in her left breast; in Sept., 1929, the radical mastectomy was done at another institution.

The only evidence of mammary cancer found on admission was a palpable lymph

Intravenous injection of colloidal silver solution.
8- 7-1929—20.3 milligrams of silver in 90 cc. of solution.
9- 5-1929—29. milligrams of silver in 110 cc. of solution.
12-14-1929—23.8 milligrams of silver in 100 cc. of solution.

Laboratory Examinations:—
10-15-1929—Pathological Report. Small-cell infiltrating cellular tubulo-alveolar carcinoma. Grade III—radiosensitive.

Blood Counts	*Hb.*	*R.B.C.*	*W.B.C.*	*Neut.*	*Bas.*	*Eos.*	*Trans. Cells*	*Large Lym.*	*Small Lym.*
8- 7-1929	75	3,900,000	5,400	84	—	2	1	3	10
8-12-1929	75	3,970,000	3,800	84	—	1	—	2	13
9- 5-1929	80	4,200,000	4,200	87	—	—	—	6	7
12-14-1929	85	4,320,000	7,800	84	—	—	1	6	9
12-17-1929	85	4,400,000	7,200	84	—	—	—	2	14

12-17-1929 Blood urea nitrogen—10 milligrams per 100 cc. of blood.

Urinalyses: Albumin present in moderate quantities on 8-7-1929; 8-8-1929; 9-5-1929; 9-6-1929; 12-14-1929; 12-17-1929; 12-17-1929. Hyaline casts present on 12-14-1929.

node in the left supraclavicular space. One post-operative low voltage x-ray cycle was given to the left chest, left axilla and left supraclavicular space. The left supraclavicular space received 3 additional x-ray treatments in 1927 and two in 1928. On April 19, 1928, a radiograph of the chest was reported as showing mottling in the parenchyma of the lungs on both sides and enlarged hilus glands. By July 29, 1929. the lungs were studded with metastases.

Intravenous administration of colloidal silver solution.
8-29-1929 30 milligrams of colloidal silver in 117 cc. of solution

Laboratory Examinations.—Urinalysis repeatedly normal.
8-29-1929—Blood count—3,950,000 Red Blood Cells per cu. mm. of blood. Hemoglobin—75%. 7,000 White Blood cells per cu. mm. of blood. Differential count—66% neutrophiles, 3% large lymphocytes, 27% small lymphocytes, 2% transitionals, 2% eosinophiles.
8-30-1929 Blood sugar—101.4 milligrams. Blood urea nitrogen—8.6 mgs. per 100 cc. of blood.

Course.—From Aug. 1, 1929, to Oct. 21, 1929, the patient lost 40 pounds in weight. There was no appreciable effect produced by the constitutional treatment. The patient is at present bedfast.

Comment

1. Five cases of inoperable cancer were selected for treatment by colloidal silver. Of these, 3 were mammary carcinomas, one was gastric carcinoma, and one was carcinoma of the cervix uteri.

2. The intravenous injection of colloidal silver solution provoked an immediate but temporary systemic reaction, consisting of chill, fever, nausea and vomiting. This constitutional reaction limited the amount of metallic colloid injected at a single dose to 30 milligrams.

3. The introduction of the colloidal silver induced no discernible changes in the composition of the blood and urine. These findings contradicted the reports of other investigators that colloidal silver induced a hypoglycemia when administered intravenously.

4. Microscopical study of one of these carcinomas removed at necropsy (Case No. One) showed no histological evidence of any influence of colloidal silver on the carcinoma cells or tumor stroma.

5. There were two instances of temporary subjective improvement which were probably due to the psychic influence of the intravenous medication; one patient gained in weight. There was never any actual decrease in size of any of the tumor masses. The progress of the disease appeared to be unaltered.

6. It is probable that the occasional beneficial result obtained in cancer therapy by the use of colloids of heavy metals, notably lead, is not due to their biologic action as foreign colloids per se, because a similar colloid, namely silver, produces no demonstrable effect on the growth of cancer in the human.

REFERENCES.

[1](a) Bell: Lancet, 1922, 204, 1005.
(b) Bell: Lancet, 1925, 209, 1003.
(c) Bell: Lancet, 1924, 206, 267.
[2]Wyard: Brit. Med. Jour., 1928—1 No. 3515, 838.
[3]Bell: Lancet, 1926, 211, 1236.
[4]Stone and Craver: Annals of Surgery, 1927, 86, 347.
[5]Cushny: Pharmacology and Therapeutics, 1924, 663.
[6]Steiger: Abs., J. A. M. A., 1917, 69, 1656.
[7]Muller: Jour. Exp. Med., 1926, 43, 533.
[8]Stewart and Parker: Amer. Jour. Path., 1926, 2, 381.
[9](a) Voigt: Biochem. Zeit., 1915, 68, 477.
(b) Voight: Zeit. d. ges. exp. Med., 1926, 52, 33.
[10]Woodard: Annals of Surgery, 1927, 86, 607.
[11]Rohdenburg: Jour. Med. Res., 1915, 31, 331.
[12]Weil: J. A. M. A., 1913, 61, 1034.

Note: We wish to express our appreciation to Mr. Edward Ellis of the Pathology Laboratory for the bacteriological and blood studies.

A Cheaper Source of Oxygen

By H. L. Arnold, M.D., *Honolulu, Hawaii*

THE increasing use of oxygen inhalation for long periods in hypoxemic states, and the considerable expense attendant upon the prolonged administration of oxygen from tanks under pressure, emboldens me to report a very inexpensive source of oxygen which is available in practically all large cities.

The now widely used Linde process for the manufacture of oxygen consists of the compression and fractional release of compressed air on a progressive plan leading to the liquefaction of air at a temperature of — 190 C. This liquid when exposed at atmospheric pressure rapidly gives off its nitrogen, since the boiling point of this gas is considerably higher than that of oxygen, and pure liquid oxygen, a thin, watery, pale blue liquid remains. At room temperature it is of course always in violent ebullition, and gaseous oxygen escapes constantly from any vessel in which the liquid is contained. This gaseous oxygen is of the highest purity, and complies with all specifications for "Medical Oxygen." Any attempt to confine it is futile and dangerous, and attendants must be warned not to attempt to shut off the flow of gas.

An ordinary steel vacuum bottle of two quart capacity filled with liquid oxygen gives off gaseous oxygen at the rate of about one liter per minute, which rate may be accelerated by shaking the bottle, or, in case a rapid continuous flow of gas is desired, by employing a non-insulated container. Glass bottles, unless of very thin walls, are prone to break when subjected to this very low temperature. A perforated rubber stopper and tube leads the gas to a small wash bottle which serves only to visualize the flow of gas, and the effluent from the wash bottle goes to the patient who receives the gas from a mouthpiece, or by inhaling it from under a small tent into which the gas is allowed to escape. The tendency to apnoea from hyperoxemia when observed may be controlled by the occasional admixture of carbon dioxide from a pressure tank being allowed to enter the tent. The relative proportions of the gases may be controlled with sufficient accuracy by comparing the streams of bubbles through the wash bottles. We employ a tent of pyramidal shape with a square base 3 feet on a side and 2 feet high. A heavy wire frame supports a cover of heavy unbleached muslin. In each of the 4 sides is a window 14x17 made of a cleaned x-ray film. A flounce 8 inches wide surrounds the base, and is tucked under pillows and bedding.

One volume of liquid oxygen gives off approximately 800 volumes of gaseous oxygen, and the local price, which is probably higher than in mainland cities, is one dollar per quart, or one dollar for 200 gallons of gaseous oxygen. By comparison of this figure with the price of compressed oxygen in your community the effected saving may be estimated.

Gas products supply-houses furnish gallon size or larger insulated containers which may be used as reservoirs for the liquid, from which the vacuum bottle may be filled as needed. The larger the bulk of liquid the slower the relative rate of evaporation, and a gallon will not be exhausted for several days. Pouring the liquid from one container to another results in the formation of dense clouds of visible water vapor, and the process looks dangerous, but is not. Contact of the skin with the liquid for more than an instant will, of course, result in frost bite, however.

Undoubtedly this source of oxygen is already being widely employed, but I have not encountered mention of it in the literature. It has been used by us for more than two years with perfect satisfaction. Naturally it is not adapted to emergency use, since, as the Scotchman said of whiskey, "It won't keep."

Editorials

ON CANCER CURES

The one encouraging sign of the present widespread discussion of an alleged cancer cure is that there seems to be developing a certain ethical sense as to the propriety of making any statement as to the supposed curative powers of any method of treatment of cancer whatsoever. During the last forty years we have seen an almost annual exploitation of "cancer cures" which have had their brief season of notoriety and public attention, and then failing, as all have failed and must fail, are passed along into the discard of oblivion. The path of progress of medical knowledge is strewn with abandoned cancer-cure wreckage of every kind and description. In a general way such cancer cures reflect the ideas of cancer etiology prevailing at the time. In the nineties of the last century and in the first decade of the present one the predominant idea as to the cause of cancer was that cancer was an infectious disease and that ultimately some specific cancer organism must be found. When found, cancer therapy would naturally resolve itself into the attempt to conquer the organism or to abrogate its action upon the body by means of antibacterial or antitoxic methods and means. It was natural that at the outset a certain analogy between cancer and infectious disease should have been thought to exist. The origin and manner of growth of neoplasms suggested in many ways the action of a parasite; and the bacteriological stage of cancer investigation was a logical and necessary one in the attainment of the knowledge of the nature of cancer which we now possess. Every form of micro-organism known to science practically has at one time or other been regarded as a possible cancer cause: there have been cancer cocci, bacilli and sipirilla figured and described, cancer yeasts and moulds have had their little day of etiologic prominence; and finally various organisms regarded as protozoa have had beautiful cycles of development illustrated in minute detail. In this connection the mistaken diagnosis of cork cells as cancer parasites may be recalled. And we just missed the possibility of including round worms and a species of taenia as specific agents of tumor etiology in the form of Spiroptera neoplastica and Taenia crassicollis. Fortunately, the experimental rôle played by these verminous parasites in the production of animal neoplasms came along after the controlling part played by heredity and cancer susceptibility in the development of neoplasm had become known to us, so that no specific agency was attributed to these worms as etiologic agents of cancer. By the end of the first decade of this century experimental animal work, together with the fuller bacteriologic and

pathologic studies of neoplasm had convinced us that cancer is not an infectious disease, and that no specific living agent exists for the production of cancer, and that the part played by living organisms in the development of neoplasm is but purely that of a secondary, non-specific extrinsic factor of irritation, which will have no effect in the production of neoplasm in any one not possessing an intrinsic cancer susceptibility or tendency. This knowledge is now generally accepted, and very few pathologists today regard the infectious theory of cancer as being any longer worthy of consideration. But still there will crop up among practitioners at large cancer-cures based on an unfounded premise of cancer as an infectious process. Mistaken conceptions regarding certain infectious growths in the lower animals, particularly the so-called Rous chicken sarcoma, have been in part responsible for the persistence of such views. By many workers the chicken sarcoma is regarded as an infectious granuloma, and not comparable to the true neoplasms of man. The last ditch of the infective theory for the etiology of neoplasm was that of Gye and Barnard, who invented an ingenious compromise between the infective and chemical theories of cancer etiology through the assumption of a *non-specific living* agent and a *specific chemical* substance, both of which are essential to neoplasm production. An assumption so far-fetched that it is amazing that it should have received any scientific consideration at all, and all attempts at the control of the Gye-Barnard work have been, as expected, wholly negative. There exists, therefore, today absolutely no proof that infection plays any specific exciting cause in the production of neoplasm, hence all cancer cures based upon such an assumption of etiology may at once be dismissed as outside the realms of possibility. No specific antibodies are formed in the bodies of cancer-patients, and all cancer-therapy in the form of serums and vaccines becomes at once theoretically impossible and practically worthless. No hope is to be held out for any curative or preventive method to be developed along these lines. This should dispose of all the cancer-cures based upon such ignorance of the actual pathologic situation; and the public should be educated as to this point, as well as the members of the profession. When once the public mind has become cognizant of the fact that cancer has no infective etiology, then much will have been accomplished to prevent cancer patients from falling victims to cancer cures. A second class of cancer therapy is based upon the equally false hopes of destroying the cancer cells within the body. In their earliest form such cures consisted in the application of caustic applications directly to the affected part. Zinc and arsenical pastes and other forms of corrosives were used for this purpose, and many patients suffered untold agony from the ulcerating and gangrenous sloughs produced by these applications, with the result of exacerbation of the growth, rather than an inhibition. The majority of the old-fashioned quack, Indian and herb cures for cancer were of this variety. Even today one meets with patients who are suffering from the use of cures reputed to "eat out

the cancer." While it is possible that certain superficial and sharply localized cancers might be destroyed by such destructive applications, such is usually not the case, and in no way can such methods be compared with those of clean surgical removal. Under the irritation of such methods cancers usually show an increased rate of growth. Moreover, the attempt to destroy neoplasms by the injection, either into their substance or into the body itself, of various lytic materials, meets with similar disappointment. A long list of such cancer-lytic substances has been tried out to no avail. It is a well known fact that the older portions of malignant neoplasms undergo degeneration and necrosis, and that almost anything injected into the neoplasm will aid in producing such regressive changes. Moreover, the spontaneous regression of neoplastic nodules may at times be so great that the nodules may be so reduced in size as to apparently disappear. Only in the case of malignant syncytioma has the spontaneous disappearance of a metastatic nodule been known to occur, but this neoplasm arising from chorionic epithelium must be considered in a class apart from those arising from the tissues and organs of the individual body. Moreover, the general effects produced by the injection of cancer-lytic material often add greatly to the tumor cachexia present, and the great majority of them only hasten the end instead of delaying it. Herein belong such substances as Coley's mixed toxins, extracts of various organs and tissues, sera and effusions from cancer patients, and various endocrinal preparations, such as the Coffey-Humber extract of adrenal cortex. It has long been known that necrosis of tissue would follow the injection of adrenal gland extracts, as for instance, gangrene of the abdominal wall in experimental animals. Such an action has in no case been shown to be specific for cancer cells alone, and the sad fact attending the use of all such lytic substances is that only the older portions of the neoplasm are affected and die, while the growth of the younger cancer cells is apparently only stimulated. At any rate rapid increase in the growth and spread of neoplasms is often seen as a result of their use. Precisely similar is the situation attending the use of the intravenous injection of colloidal preparations of the heavy metals, lead, gold, silver, copper, etc. Was no lesson learned from the Blair Bell colloidal lead fiasco! Any pathologist with only a rudimentary knowledge of general pathology should have been sure as to the ultimate failure of such a treatment, and of the falseness of the premises upon which the philosophy of this treatment was built. Why was Bell's statement as to lead being lytic for chorionic epithelium not challenged? There was absolutely no proof of such an action of lead upon the placental ectoderm, or of his interpretation of the action of lead in producing abortion. What was known of the vascular action of lead poisoning should have been sufficient to offset these unwarranted claims as to the specific destructive action of lead upon embryonal cells. And yet so curiously unbalanced is human psychology that a noted pathologist supported Bell's claims, just as a reputable journal of medicine uttered

glowing prophecies as to the important therapeutic significance of the Gye-Barnard fiasco. In such cases the conservative doubting pathologist finds himself too often in Cassandra's position, and is put down for a pessimistic prophet. His only satisfaction is that if he lives long enough he is sure to have the last laugh. But joking aside, this is all too serious a matter for even satisfaction at having correctly prophesied. None of the carefully controlled experimental work in this line has shown the slightest specific action of any of the colloidal metallic preparations upon the cells of neoplasm. To kill all of the cancer cells by any method of chemical therapy would mean the death also of the body cells, and what is most probable is, that they would die before the cancer cells, because of the greater emancipation of the latter from the general body metabolism and chemistry. It seems certain that nothing can be hoped for in the nature of any substance that injected into the body will kill all the cells of the parasite neoplasm and leave undamaged the cells of its host. The world is not built upon that line. It is not pessimism which makes us declare that a cancer cure of this nature will never be found; in the very nature of things it does not and cannot exist. And further, we may safely declare that a cancer-cure as such is beyond all probability of achievement. Cancer is not simply a local disease, as is a streptococcus boil; we know now that it is primarily a disease of the entire organism, an anomaly of the individual constitution. Moreover, a local organ or tissue predisposition is also necessary for its development. The general constitutional anomaly determines whether an individual can have a cancer; the local organ predisposition determines the site of the cancer. Further, there is the external factor of irritation to be considered. We do not yet know whether this extrinsic factor can take the place of the local organ predisposition, but there appears to be some evidence to the effect that it can. The general constitutional cancer-susceptibility is an inherited one, although this inheritance may manifest itself in different forms in different families. Further, the members of a family possessing the cancer susceptibility do not all possess the same degree of strength of the cancer predisposition; in some the cancer may appear early and without the operation of the extrinsic factor; in other members of the same family the cancer susceptibility may not show itself until very late in life, or be brought out only through the action of the extrinsic factor. The number of cancer deaths must be very much less than the number of individuals possessing the cancer susceptibility, as many of the latter will die of other diseases before the cancer susceptibility can assert itself. If we can promise no specific cure for cancer what can we do to restrict its ravages. We may attempt to breed out the intrinsic cancer susceptibility, but that will take many generations of eugenic breeding. Against the development of the local organ predisposition there is much greater ground for hope. Congenital anomalies in the Cohnheim sense of misplaced tissues may be corrected or removed, and the extrinsic factors producing chronic

irritation favoring cancer development may be largely controlled or abrogated. Much can be done in this direction for the prevention of cancer development. And in the case of its development early diagnosis and complete and extensive surgical removal will tend to bring about more complete cures than we are seeing today. There is much room for advance along the lines of both early diagnosis and thorough removal. Conservatism as to the extent of operation in the removal of a primary cancer is the chief mistake made by surgeons in the treatment of cancer. With a better knowledge of the pathology of the different forms of neoplasm surgeons will cease to "shell out" neoplasms or to cut too closely to the border of an infiltrating growth. From the standpoint of the pathologist these are common errors of surgical technique. As to the curative results from x-ray and radium irradiation these methods of treatment of malignant neoplasms have proved very disappointing. Particularly is the irradiation of the affected area after operative removal of the neoplasm now being advised against, as some workers believe that such irradiation favors the occurrence of metastases. To sum up, there is little or no chance of any specific therapeutic agent for cancer ever being found; therefore, the advertisement and exploitation of so-called cancer cures leads only to the tragic blasting of unwarranted hopes excited in the lay mind through such announcements. Would it not be much better to prevent such public calamities by the development of a strong ethical sense that would lead to the censuring of the premature announcement to laymen of all experimental work connected with cancer therapy? Such exploitation should be regarded as beyond the limits of medical ethics and of common decency.

Abstracts

The Etiological Rôle of Bacteria in Bile Peritonitis. An Experimental Study in Dogs. By ALLAN G. REWBRIDGE and L. S. HRDINA (Proc. Soc. f. Exper. Biol. and Med., March, 1930, p. 528).

According to the prevalent view "bile peritonitis" is due to the toxicity of bile. Horrall observed that when bile was allowed to drain continuously into the peritoneal cavity the dogs died within 24 hours. He attributed the cause of death to the toxicity of the bile salts. In order to gather additional data on the mechanism of "bile peritonitis" the following investigation was carried out. In a series of 20 dogs, peritonitis was produced by allowing bile to drain into the peritoneal cavity. Determinations of bilirubin by the Van den Bergh method and bile salts by the Pettenkofer reaction developed by Aldrich were made on blood drawn from the femoral veins of the dogs 4 and 18 hours after their operations. No increase of bilirubin or bile salts could be detected by these methods even though the animals were dying as the result of their peritonitis. At necropsy the peritoneum was inflamed, the surfaces covered with a thin layer of fibrin and a few small areas of fat necrosis were observed around the pancreas. The peritoneal cavity contained a serosanguinous exudate in which were observed polymorphonuclear leukocytes and Gram positive bacilli. This organism was cultured from the peritoneal exudates of all 20 dogs studied. Cultures of bile removed from the gall bladder at the time of operation were all sterile except one in which grew a short Gram negative bacillus. A 10 per cent solution of bile salts filtered through a Berkefeld filter, and shown to be sterile when introduced into the peritoneal cavity produced a peritonitis identical with "bile peritonitis," except that fat necrosis was more extensive. Of the 20 dogs in this experiment smears and cultures of the peritoneal exudate showed the same Gram positive bacillus in 19. In one no growth occurred. Twenty c.c. of an 18 hour broth culture of this bacillus when introduced into the peritoneal cavity produced a peritonitis identical with "bile peritonitis" except that areas of fat necrosis were absent. From the peritoneal exudate the same Gram positive bacillus were absent. From the peritoneal exudate the same Gram positive bacillus was cultured. The bacillus, a strictly anaerobic organism grows readily in broth and produces stormy fermentation within 18 hours in milk. The colony is large on an anaerobic blood agar plate, varies its color from yellow to brown and is surrounded by a wide zone of beta hemolysis. It stains well with methylene blue and positively by Gram's method. It varies considerably in length, is broad, square ended and has an occasional subterminal spore. This organism is either *B. welchii* or some other bacillus closely related to it. These observations tend to show that "bile peritonitis" is an infection produced by *B. welchii* or some other anaerobic bacillus closely related to it. (The weak spot in this investigation is the autopsy demonstration of the supposed infecting organism. Postmortem invasion of the peritoneal cavity is not ruled out. *Editor.*)

Effect of Diet on the Healing of Experimental Gastric Ulcer. By G. B. FAULEY and A. C. IVY (Proc. Soc. of Exper. Biol. and Med., March, 1930, p. 531).

Ferguson was able to produce uniformly in rabbits gastric ulcers which persisted 2-8 months or longer. He incised the anterior wall of the stomach and at the point of incision removed a piece of the mucosa, and then closed the stomach by a silk suture, the rabbits being kept on a diet of hay, oats and carrots. It occurred to Fauley and Ivy that this observation provided a method of studying the effects of diet on the healing of this experimental ulcer. In the first series of

rabbits used they found that if a lesion was made in the posterior wall of the stomach in which no silk suture was present and the rabbits placed on the stock diet of hay, oats and carrots, that the posterior lesion healed in 30 days, but the anterior lesion did not. This showed that the silk suture was a factor in the delayed healing and that in the absence of the silk, diet played no rôle in delaying healing. Anterior lesions of the Ferguson type were made in 29 rabbits. Twelve were placed on the stock diet and 17 on a diet of milk, bread and mashed boiled carrots. The rabbits were sacrificed on the 30th day. All of the 12 rabbits on the rough diet had ulcers on the 30th day. Only 3 of the 17 on the "soft diet" had ulcers. The results show that the silk suture *per se* is not sufficient to prevent the ulcer from healing and that a "rough diet" plus the silk suture factor are sufficient to produce a chronic gastric ulcer, grossly and histologically, and that a "soft diet" favors the healing of gastric lesions. The same results were obtained in a series of 4 rabbits on a rough diet in which a gut suture was used in place of silk. In another series of 4 rabbits which were kept on a diet of dry "quick rolled oats" with a fiber content of only 1.4 per cent ,the ulcers failed to heal. On opening the stomachs of these animals, the contents were found to be pasty and dry as that found on the rough diet. This indicates that the fluidity of the gastric contents is also a factor determining the healing of gastric lesions.

Reflexes from the Gall bladder to the Heart. By WILLIAM C. BUCHBINDER (Proc. Soc. of Exper. Biol. and Med., March, 1930, p. 542.)

The sudden release of bile obtained by incising the gall bladder of a decerebrated or ether-anesthetized frog is almost invariably attended by an abrupt change in the rate and character of beating of the heart. The first event is a transient arrest of the entire heart lasting between 1 and 10 seconds, almost always followed by a sinus bradycardia lasting from one-half to ten minutes. Subsequently there is a return to the initial rate of beating, although in a few instances progressive slowing, leading to excessive dilation and permanent arrest, have been observed. Not infrequently the first event to be noted is a transient acceleration which precedes the slowing. The heart appears to beat much more forcibly with the inception of the slower rate. The latent interval for the reflex is a fraction of a second to a second or more. Electrocardiograms made from base to apex show the cessation of activity of the sinus and ventricular portions of the heart followed by increased amplitude of R and a rather characteristic inversion of T. That the changes in the initial and final ventricular complexes are not directly associated with the reflex are to be found in the repetition of electrical effects, following an occasional sinus block which appears spontaneously after the resumption of a normal rate of beating. Such an effect is quite comparable to aberrant complexes following premature beats in mammalian electrocardiograms. Prolongation of the PR interval does not ocur cand an extrasystolic arrhythmia cannot definitely be determined in the electrograms. Atropinization, decapitation or section of the vagi prevent the reflex. In the frog, there is, therefore, a specific reflex from the gall bladder to the heart which appears to have a vagal origin. Katz has suggested that the characteristic inversion of T with the inception of a slower rate of beating may well be a vagal effect producing asynchronous cessation of electrical effects in a ventricle in which there is decreased conduction. Irritation of the gall bladder by thermal or other instrumental means does not produce the succession of events noted when the stimulus is adequate. Acute pressure changes in the extrahepatic ducts are thought to constitute an adequate stimulus for the production of the reflex. It has also been suggested that this may be the mechanism operating for the production of the arrhythmias frequently seen in the human with so-called gall bladder disease, especially cholelithiasis.

The Serum Treatment of Pneumonia. By E. S. MILLS (Canad. Med. Assoc. Jour., April, 1930, p. 488.)

Mills reports results on a series of 52 cases of pneumonia treated with Felton's serum, at the Montreal General Hospital.

While small, the results are in agreement with the favorable results already published in the larger clinics in New York. In the 52 cases treated with serum there were 6 death, a mortality percentage of treated cases of 11.5 per cent. During the same period there was 20 untreated cases with 10 deaths, a mortality percentage in the controls of 40 per cent. The mortality in 400 cases at Montreal General Hospital before serum treatment was begun was 25 per cent. As a result of this experience and of others it would seem that the serum has little effect on resolution, which pursues its regular course, neither hastened nor retarded. The one great and significant fact is that the mortality has been considerably reduced by the administration of Felton's serum.

The Inhalation of Pure Oxygen in the Treatment of Disease. By JOHN H. EVANS (Canad. Med. Assoc. Jour., April, 1930, p. 518.)

The therapeutic value of inhaling pure oxygen for long periods of time has not been investigated. Considerable research has been done on therapy with 40-60 per cent oxygen, but the range of 60-100 per cent has been avoided because of the fear of producing harmful results. Medicinal and commercial oxygen is about 99.5 per cent pure. This is what is meant when the terms "pure" or "100 per cent oxygen" are used. Evans endeavours to establish that pure oxygen can be safely administered by means of the face mask or nasal inhaler in cyanotic patients continually, as long as the cyanosis persists; secondly that it is advisable to administer 100 per cent oxygen early in pneumonia, as soon as the diagnosis is made, and continuing it throughout the course of the disease, intermittently if there is no cyanosis, and continually if there is; thirdly that daily inhalations of oxygen are beneficial in a number of pathological conditions where there is no apparent lack of oxygen in the blood. As a result of his experience, he concludes, that the continuous administration of pure oxygen, by means of the face mask or nasal inhaler over a period of days, to anoxemic patients has been productive of only beneficial results. The early administration of pure oxygen in pneumonia is a potent factor in reducing the mortality rate. The administration of oxygen for one to several hours daily has proved beneficial in cases of cardiac decompensation, asthma, hay fever, influenza, extensive burns, pulmonary embolism and hyperthyroidism.

Reviews

Progressive Relaxation. A Physiological and Clinical Investigation of Muscular States and Their Significance in Psychology and Medical Practice. By EDMUND JACOBSON, A.M., Ph.D., M.D. 429 pages, 68 figures. The University of Chicago Press, Illinois, 1929. Price in cloth, $5.00.

The great importance of rest in the treatment of disease is generally recognized, but in spite of its importance the field has remained practically unexplored from a scientific standpoint. Rest has been found useful in treatment in all branches of practice. It is commonly prescribed in various acute and chronic infectious diseases, in the more severe metabolic and nervous disorders, in gastrointestinal and general systemic affections, in asthenia, and in a large variety of surgical conditions. While devoting much effort to the development of other forms of therapeutic measures, medicine has used this, her oldest remedy, wholly naively and with little attempt at systematic study. It is the hope of the author of this volume to draw attention to the problems of fatigue and rest, and to present a method that will interest the geenral practitioner, the internist and the surgeon, no less than the neurologist. During neurosis there is failure to relax; recovery by whatever route attained generally is characterized by a return to a fairly normal relaxed state. The author has sought to test directly the effects of cultivating relaxation during neurosis. He describes a method of relaxation to quiet the nervous system, including the mind. Because of reflex connections, the nervous system cannot be quieted except in conjunction with the muscular system. The whole organism rests as neuromuscular activity diminished. The possible range of usefulness of the method of relaxation described in the book should not be narrowly restricted to neurology, since it may conceivably be applied wherever rest is useful in the practice of medicine. The present studies of relaxation were begun twenty years ago, and are still in an early stage. Further investigations are under way, and many more must follow on the various systems before the range of the psysiological effects of relaxation and of the clinical applications can be fully stated. The author suggests that the term neuromuscular hypertension should largely replace the term neurasthenia, except perhaps in a relatively few instances where exhaustion can be actually demonstrated. Phenomena of neuromuscular hypertension occur in the guise of symptoms, causes or effects almost throughout the whole range of the practice of medicine and surgery; and the opportunity for a wide and varied application of a method of relaxation is suggested. The author describes a method of progressive relaxation which can be applied to the treatment of acute and chronic neuromuscular hypertension, states of fatigue and exhaustion, debility, toxic goiter, insomnia, alimentary spasm, chronic pulmonary tuberculosis and vascular hypertension. The fact is emphasized that in the general practice of medicine and surgery neuromuscular methods may be used along with diet, drugs, operation, and other therapeutic measures. The practitioner will find this bok interesting and suggestive.

The Conquest of Cancer. By Radium and othe Methods. By DANIEL THOMAS QU .Y, M.D., F.A.C.S., Instructor in St y in the University of Nebraska C ge of Medicine. 539 pages, 334 il- l ations. F. A. Davis Company, Phila- ia, 1929. Price in cloth, $6.00

'1 .s book is an extraordinary collection of pathological ignorance and misconceptions. The general character of the pathology is shown in the statement that old age "is a disease, due to the inroads of the chronic infections which the individual has picked up during his life time." The pathology of

neoplasm is of the same grade of value. The case made out for the value of radium in the treatment of cancer is far from being convincing.

Clinical Obstetrics. By Paul T. Harper, Ph.B., M.D., Sc.D., F.A.C.S., Clinical Professor of Obstetrics, Albany Medical College. 629 pages, 250 figures, with legends and charts. F. A. Davis Company, Philadelphia, 1930. Price in cloth, $8.00.

This book is concerned with the description of the natural phenomena of parturition, with detailed consideration of the abnormalities of pregnancy, labor and the puerperium to which frequency of occurrence and the responsibilities involved give prominence, and with exposition of the operative procedures applicable to them. It is assumed that the reader is well-grounded in fundamentals from textbook study, and that such knowledge has been broadened by familiarity with the works of reference and with current literature. In his introduction the author insists upon the importance of visualizing each and every process concerned. The book is a study of individual reaction to obstetrical problems as they have presented themselves to the author. In its telling an effort has been made to place principles involved over and above the procedures that might be carried out. Deductions that individual situations seem to warrant replace extended comment and multiplicity of views, and this of necessity makes the account personal. The text is illustrated with simple diagrams having appropriate legends. They are intended to help the reader to visualize what is set down in order to make him see what is the purpose of the writer to convey. Having acquired the habit of visualization the reader makes his own mental pictures. The work is written with the firm conviction that clinical proficiency depends upon an analytical attitude toward all that is seen, and upon ability to isolate fundamentals and to make logical deductions therefrom, rather than upon mere dexterity in following out the details of operative procedures. The obstetrical material of the book is complete. well organized and clearly presented in an individual manner which makes it interesting and valuable.

The Sthenics. The Chord Invisible. By Sir James K. Fowler, K.C.V.O., C.M.G., M.A., M.D. MacMillan and Co. Limited, London, 1930. 81 pages. Price in cloth, $1.40.

This little volume deals with those human beings, men and women, who possess a more highly sensitized central nervous system than is common to the race. The author does not have in mind those whose characteristics are to be described as merely "neurotic" or "neurasthenic," "highly strung" or as possessing the "artistic temperament," all of whom can easily be distinguished by a characteristic facies, or appearance or a manner which enables the trained observer within a few minutes to place them in their class. On the other hand a study much closer and more prolonged than this and a knowledge far deeper is required to recognize and unravel the very diverse and usually complex character of the type which the author has in mind, and which he styles the Sthenics or Hypersensitives. The positive characteristics of these it is not easy to define. Each one will be the result of a different heredity, and necessarily each will differ from all the others in some respect. They present great variety in physique, mentality, ability and temperament. In spite of these differences they present in common some qualities or mental characteristics by which they may be identified. The most obvious of these is the manifestation of vitality to an unusual degree, an interest in many things ,and a capacity for sharing in the interests of others; a fertile imagination, which leads to the evolution of many schemes, of which, perhaps, a few only come to maturity. Their clearness of vision leads them to see the thing as it will appear when complete, before it is begun, and to overlook the difficulties which lie in waiting between inception and completion, and the necessity of securing the co-operation of many interests. In early life it may be obvious that they possess ability which may lead to distinction, and somewhat later these hopes are partially realized; usually, however, performance falls somewhat short of promise, some obstacle within preventing the attainment of the degree of success which was expected. High

attainment, tempered by relative failure, may persist throughout life, and the former may so overshadow the latter that it is not apparent. The element of failure is either not recognized, or, if so, is soon forgotten. Sound judgment, the greatest of faculties, is lacking, and this is apt to mar the whole. They are inclined to be ruthless in order to attain the end in view. They are essentially solitary workers and most suited for one-man jobs. They are not good judges of character. They tend to be inconsiderate in conduct toward subordinates. Socially they are always interesting, often brilliant and attractive; their presence acts as a stimulant to others on whom they are able to impart some of their stock of vitality. Their memory may be prodigious, and the variety of subjects upon which they are able to speak with a full knowledge is one of the factors which go to the making of a personality to which all are drawn. Among their physical characteristics is hypersensitiveness of the skin and mucous membranes. When ill they do not make good patients. They react badly to operations, with extreme restlessness and irritability. They are subject to spasms originating in some source of irritation and involving a limb and part of the trunk. Sthenics have been concerned in all the great friendships and the great quarrels of history. The author believes that Napoleon was a sthenic and not an epileptic. He also places Lord Curzon and Sir Edward Marshall Hall in this group. In conclusion he explains the sthenic individual on a biochemical basis of an over-secretion of adrenin.

The Principles of Bacteriology and Immunity. By W. W. C. Topley, M.A., M.D., M.Sc., F.R.C.P., Professor of Bacteriology and Immunology, University of London; and G. S. Wilson, M.D., M.R.C.P., D.P.H., Reader in Bacteriology and Immunology in the University of London, London School of Hygiene and Tropical Medicine. Two Volumes, 1300 pages, 241 figures. William Wood and Company, New York, 1929. Price in cloth, $15.00.

Volume I treats of General and Systematic Bacteriology; Volume II of Infection and Resistance and the Application of Bacteriology to Medicine and Hygiene. The authors have attempted, on the basis of their personal experience in postgraduate and undergraduate teaching, to provide a textbook which will be of service to those students of medicine and biology who wish to make a serious study of bacteriology and its application to the problems of infection and resistance. The order of presentation is logical; the student should gain some knowledge of bacteria as a distinctive class of living things, and of their systematic relationships and ecology, before considering their reactions with more highly differentiated organisms. To bring the material within a reasonable compass, all detailed descriptions of technique have been omitted. The available evidence in each case is presented; no attempt has been made to simplify the issues by limiting the material of the book to well-attested facts or to undisputed conclusions. Both sides of the disputed and unsettled problems of bacteriology are presented. Literature is given at the close of each section. The material presented appears to be fairly well brought up to date, and is clearly and concisely stated. The illustrations are only fair. The chapter on bacterial variation is inadequate, because of the great prominence of this subject at the present time. As this is a very living matter of bacteriologic discussion, it should have been more completely treated. The authors apparently accept the legend of the importation into Europe of syphilis by the Columbian crews. The work of the Dicks on scarlet fever is quite thoroughly reviewed. Tularemia is included in the list of diseases of man, but undulant fever does not appear in the index. On the whole, these two volumes offer a well-rounded survey of modern bacteriology, brought up to date.

College News Notes

COLLEGE NEWS NOTES

Dr. Howard L. Hull (Fellow), Elma, Washington, addressed the Tuberculosis League of Benton County, on March 26, on the subject "Tuberculosis in Childhood." He addressed the Kittitas County League on the same subject on March 27, and the Yakima County League on March 28.

Dr. W. W. Britton, who has been for twelve years with the Homan Sanatorium, has become Medical Director of the Southern Baptist Sanatorium, El Paso, Texas. Dr. Britton succeeds Dr. J. D. Riley, who has been elected Superintendent of the Arkansas State Sanatorium at Booneville. The Southern Baptist Sanatorium is a regular advertiser and exhibitor with the American College of Physicians.

At the meeting of the Dallas Southern Clinical Society on April 14, the following Fellows of the College delivered addresses:

Dr. Francis M. Pottenger, Monrovia, Calif.

Dr. Logan Clendening, Kansas City, Mo.

Dr. A. B. Moore, Rochester, Minn.

Dr. C. C. Sturgis, Ann Arbor, Mich.

Dr. Ralph Pemberton (Fellow), Philadelphia Orthopaedic Hospital and Infirmary for Nervous Diseases. On March 14, he addressed the medical section of the Rutgers University Club at New Brunswick, New Jersey, and on March 26, he delivered one of the Wednesday addresses of the Fifth Avenue Hospital, New York City.

Dr. Arthur C. Brush (Fellow), Brooklyn, is Consulting Neurologist to the Coney Island Hospital.

Dr. Emil Koch (Fellow), Brooklyn, is President of the Staff Society of the Bushwick Hospital. Other Fellows of the College who are members of the Bushwick staff are Dr. Joseph F. Paulonis, Dr. Morris Weissberg and Dr. Charles Eastmond, all of Brooklyn.

Dr. C. S. Danzer (Fellow), Brooklyn, has been appointed Attending Physician to the Cumberland Hospital, Brooklyn, Department of Public Welfare, City of New York.

Under the Presidency of Dr. Walter E. Vest (Fellow), Huntington, the West Virginia State Medical Association will hold its annual meeting at White Sulphur Springs, May 20-22.

Dr. Sydney R. Miller and Mr. E. R. Loveland, President and Executive Secretary, respectively, of the College were guests at a luncheon given by Dr. L. B. McBrayer (Fellow), Secretary and Treasurer of the Medical Society of the State of North Carolina, at Pinehurst on April 29. During the annual meeting of that society, Dr. McBrayer initiated a sectional meeting of all of the Fellows and Associates of the College from the State of North Carolina. This plan has proven very beneficial in getting members of the College acquainted with one another, and to foster pleasant associations among our members in stated localities.

Dr. Horton Casparis (Fellow), Professor of Pediatrics at Vanderbilt University, Nashville, addressed the semi-annual meeting of the Southwestern Virginia Medical Society at Radford (Va.), March 24-25.

Dr. LeGrand Kerr (Fellow), Brooklyn, is the author of a treatise on the subject "A Contribution to the Cause of Universal

Peace," which is said to have been responsible for the adoption of a joint resolution in the House of Representatives for the establishment of a Peace College. The resolution provides "that the President in his discretion appoint five persons, one of whom shall be a member of the Senate, one of whom shall be a member of the House of Representatives, one of whom shall be the President of a well-recognized University, one of whom shall be an industrialist, and one of whom shall be a member of the armed forces of the United States, to constitute a Committee for the purpose of conference and study to the end that its members may discover the best ways and means whereby the United States Government can establish an institution to be hereafter known as the United States Peace College, same to be situated in the City of Washington, District of Columbia." The resolution further provides an appropriation of $100,000 to be used by this Committee in its study and research, and to report to both Houses of Congress its findings and conclusions.

Dr. Joseph F. Paulonis (Fellow), Brooklyn, is President of the Brooklyn Pediatric Society.

Dr. Stuart Pritchard (Fellow), Battle Creek, addressed the Indianapolis Medical Society and the Marion County Tuberculosis Association, April 8, on the subject, "Significance of Cough."

Dr. John Severy Hibben (Associate), Pasadena, addressed the Pacific Physiotherapy Association, March 26, on "The Visible Spectrum and Infra-Red Frequencies."

Dr. Daniel N. Silverman (Fellow), New Orleans, was elected President of the New Orleans Gastro-Enterological Society, January 23.

Dr. Robert A. Peers (Fellow), Colfax, Cal., and Dr. Henry Chesley Bush (Fellow), Livermore, Calif., addressed the California Tuberculosis Association at Merced, April 7-8, on "Blood Sedimentation in Tuberculosis" and "Parenchymatous Lesions in Childhood," respectively.

Dr. Alphonse McMahon (Fellow), St. Louis, addressed the Central Illinois Medical Association at Decatur, Illinois, March 25, on "The Heart in Hyperthyroidism."

Dr. Leroy Sante ((Fellow) and Dr. Jacob J. Singer (Fellow), both of St. Louis, addressed the St. Louis Medical Society, March 25, on "Use of X-Rays in the Detection of Chronic Lung Suppuration" and "Tumors of the Chest," respectively.

Among the speakers at the one hundredth annual meeting of the Tennessee State Medical Association at Nashville, April 8-10, under the Presidency of Dr. Leon T. Stem (Fellow), Chattanooga, the following Fellows delivered addresses:

Dr. Hugh C. Cumming, Surgeon General, U. S. Public Health Service, Washington.

Dr. James S. McLester, Birmingham.

Dr. Walter C. Alvarez, Rochester, Minn.

Dr. Henry J. John (Fellow), Cleveland, spoke before the Academy of Medicine of Cincinnati, March 10, on "Diabetes."

Dr. John H. Musser (Fellow), New Orleans, was the principal speaker at the banquet of the Birmingham Clinical Club, recently.

Dr. Harold W. Dana (Fellow), Boston, on March 7, 1930, was appointed Visiting Physician to the Boston City Hospital, being promoted from the position of Assistant Visiting Physician.

Dr. Orlando H. Petty (Fellow), Philadelphia, is the author of an article, "Treatment of Diabetes," which appeared in the March issue of the Pennsylvania Medical Journal.

The fifty-seventh annual meeting of the Northern Tri-State Medical Association was held at Fort Wayne, April 8. Among the speakers and their subjects were:

Dr. Robert M. Moore (Fellow), Indianapolis
'Observations on Heart Diseases"
Dr. Chester W. Waggoner (Fellow), Toledo
"Economic Side of Medicine"
Dr. Charles A. Elliott (Fellow), Chicago
"Treatment of Liver Diseases"

Dr. David P. Barr (Fellow), St. Louis, addressed the St. Louis Medical Society on March 18 on the subject, "Chronic Types of Arthritis."

Dr. Paul Dudley White (Fellow), Boston, addressed the Norfolk (Virginia) County Medical Society, February 17, on "Prevention of Heart Disease."

Dr. Clarence A. Smith (Fellow), Seattle, addressed the King County Medical Society of Washington on April 7 on "Galvanic Therapy."

Dr. Charles A. Elliott (Fellow), Chicago, delivered a paper before the Northeastern Indiana Academy of Medicine at Kendallville, February 27, on "Treatment of Hepatic Disease."

At the twenty-sixth annual meeting of the Council on Pharmacy and Chemistry of the American Medical Association in Chicago, March 7-8, the following Fellows of the College, who are members of the Council, were present:

Dr. Torald Sollmann, Vice Chairman of the Council, Professor of Pharmacology and Materia Medica, Western Reserve University, School of Medicine.

Dr. W. McKim Marriott, Professor of Pediatrics, Washington University, School of Medicine.

Dr. W. W. Palmer, Bard Professor of Medicine, Columbia University, College of Physicians and Surgeons.

Dr. Ernest E. Irons, Clinical Professor of Medicine and Dean, Rush Medical College.

Dr. A. J. Carlson, Professor of Physiology, University of Chicago.

Other Fellows of the College who are members of the Council include:

Dr. George W. McCoy, of Washington, D.C., and Dr. Leonard G. Rowntree of the Mayo Clinic.

Dr. Julius Hess (Fellow), Professor and Head of the Pediatric Division, University of Illinois, College of Medicine, Chicago, has been appointed a member of the Council's newly established Committee on Foods.

Dr. William Gerry Morgan (Fellow), President-Elect of the American Medical Association, was one of the guests at the annual banquet of the George Washington University Medical Alumni Association on March 5.

Col. Bailey K. Ashford (Fellow), Professor of Tropical Medicine and Mycology, School of Tropical Medicine of Porto Rico, has been chosen by the Association of Military Surgeons of the United States as lecturer of the Kober Foundation for 1930. On March 28, Dr. Ashford will deliver a lecture on "Significance of Mycology in Tropical Medicine" in Washington.

Dr. Tracy R. Love (Fellow), Denver, addressed the Northeast Colorado Medical Society, at Sterling, Colo., recently on "Gastric Disturbances and Diabetes Mellitus."

Dr. Shaul George (Fellow), Pittsburgh, spoke on "Treatment of Pneumonia" before the Allegheny County Medical Society on March 18.

Dr. George W. McCoy (Fellow) of the U. S. Public Health Service, Washington, was one of the speakers at a symposium on psittacosis held by the Greater New York Public Health Officers' Association on March 25.

The Executive Secretary of the College announces the following gifts of publications by members to the College Library:

One reprint, Dr. B. S. Pollak (Fellow), Secaucus, N. J., "Ethical Hospital Concepts."

One reprint, Dr. Samuel E. Munson, (Fellow), Springfield, Ill., Hypertension."

Two books, "The Creed of A Biologist" and "Old Age," by Aldred Scott Warthin (Master), Ann Arbor, Michigan. These books were contributed by Mr. Paul Hoeber of New York City, the publisher.

Seven reprints, Dr. Thomas Klein (Associate), Philadelphia, Pa., "Agranulocytic Angina," "Abdominal Pain Resulting from Thoracic Lesions," "The Use of Coley's Mixed Toxins in the Treatment of Chronic Arthritis," "Syphilitic Splenomegaly Associated with an Osteomyelitis of the Clavicle," "Pulmonary Complications of Paratyphoid Fever," "Pulmonary Tuberculosis and Influenza," "Chronic Arthritis."

The following additional gifts of reprints contributed to the College Library of publications by Fellows are asknowledged:

Dr. Frank Smithies (Master), Chicago, Ill.:

"Clinical Manifestations in Gall Bladder Disease. A Study of 1000 Operatively Demonstrated Cases"

"Nonsurgical Drainage of the Biliary Tract" (With Karshner & Oleson)

"The Diagnostic and Therapeutic Value of Non-Surgical Biliary Tract Drainage in Patients Exhibiting Biliary Tract Disease Upon Whom Snrgical Procedures Have Been Performed Previously" (With Oleson)

"Primary Carcinoma of the Gall Bladder"

"Gastro-Duodenal Hemorrhage"

"Advanced 'Hemolytic' or 'Pernicious' Anemia; Abscesses of the Roots of the Teeth; Chronically Infected Appendix and Gall Bladder; Splenitis and Perisplenitis"

"Deep Urethral Obstruction Caused by Carcinoma of the Prostate Resulting in Enormous Dilatation of the Urinary Bladder; General Arteriosclerosis, with Arterial Hypertension, Cardiac Hypertrophy and Interstitial Nephritis; Chronic Pancreatitis"

"Observations Upon the Nature, Diagnosis and Clinical Management of Gastric Ulcer"

"Epidemic Encephalitis (Sleeping Sickness', 'Lethargic Encephalitis,), Chronic, Non-Active, Peptic Ulcer"

"Thrombosis of Cerebral Arterioles and Myocardial Inefficiency Producing Epileptiform Attacks; Infected Tonsils and Roots of the Teeth"

"Myocardial Weakness, Cardiac Dilatation, Paroxysmal Tachycardia,' Pulmonary Edema, Severe, 'Secondary' Anemia, Abscesses of the Roots of the Teeth and Obesity"

"Presidential Address" (American College of Physicians)

"A Treatment of Gastric Ulcer Based Upon Modern Clinical Histopathological and Physiological Investigations"

"On the Etiologic Relationship Existing Between Gastric Ulcer and Gastric Cancer"

"Symptoms and Signs of Gastric Cancer; an Analysis of 712 Consecutive Operatively and Pathologically Proved Cases"

"A Consideration of Factors Concerned in the Production and the Healing of Peptic Ulcer, with a Report of the Results of Treatment of 470 Patients by the 'Physiologic Rest' Regimen"

"The Clinical Significance of Vicarious Gastrorrhagia"

"Benign Pyloric Stenosis and Its Management"

"Non-Surgical Drainage of the Biliary Tract: Its Usefulness as a Diagnostic and Therapeutic Procedure"

"On the Origin and Development ot Ethics in Medicine and the Influence ot Ethical Formulae Upon Medical Practice"

"Relationship of Infection to the Production of So-Called 'Pernicious Anemia' and its Significance with Regard to Treatment of Such Anemia"

Dr. Alvin E. Siegel (Fellow), Philadelphia, Pa.:

"Typhoid Fever in Infancy."

"Respiratory Diseases of the New-Born."

"Pooled Adult Blood Serum as a Prophylactic Measure in a Measles Epidemic in an Institution."

OBITUARY

PHILIP SEDDON ROY, M.D.

Philip Seddon Roy, one of the first to be accorded Fellowship in the American College of Physicians, (1916) died December 18, 1829. He wash born in Tappahannock, Virginia, April 15, 1861. His father, Thomas Seddon Roy, and his mother, Fanny Burgess Micou, both died during his infancy.

After high school he graduated in 1880 from the Medical Department of the University of Virginia, at 19, and later took a post graduate course at Jefferson Medical College.

Dr. Roy married Miss Alice Fitzhugh of Fredericksburg, October 23, 1890, who survives him.

Dr. Roy practiced for a short time in Fredricksburg, Virginia, but in 1887 moved to Washington, D.C., where he remained active until his last illness. Confining his work to internal medicine he was an authority on cardiovascular diseases. He published between twenty and thirty papers, the first "Heart Failure" appearing in the Journal of the American Medical Association, 1890. Preeminently a practical clinician, he was a deep student and constant reader. Sir James McKenzie was his ideal and he delighted in quoting him verbatim.

While always a regular attendant at Medical Society meetings, his interest in organized medicine really was crystalized after 1910, after which time he served as Vice President and later President of the Medical Society of the District of Columbia. He was alternate delegate to the American Medical Association from 1914 to 1926 and delegate, 1927 and 1928; Vice President of the Washington Academy of Sciences in 1918.

He was a member or fellow of the Medical Society of the District of Columbia; the American Medical Association; American College of Physicians; Medical Society of Virginia; Southern Medical Association; Medical History Club of Washington; American Therapeutic Society; Medical Society of Virginia, Maryland and the District of Columbia; Washington Academy of Sciences; University Club of Washington and the Colonnade Club of University of Virginia.

Those who met him at Association meetings, where he had friends by the hundreds, were perhaps most charmed with Dr. Roy's geniality and wholesomeness. His little dinners of recent years to the President and President Elect of the American Medical Association will be long remembered.

Those of us at home think of his loyalty to friends, generosity, honesty and uprightness.

The loss of Philip S. Roy to the profession was felt deeply by his fellow physicians and many patients when he died from angina pectoris in his sixty-ninth year.

(Prepared by J. Russell Verbrycke, Jr., M.D., F.A.C.P.)

Dr. Edward Vernon Silver, a Fellow of the American College of Physicians, died at his home in New York on March 5. 1930.

Dr. Silver was prepared for college at the Brooklyn Polytechnic Insttute, at St. Johnsbury Academy, Vermont,

and finally at Phillips-Andover. He was active in the social life of his college, sang in the class glee club, and was a member of Delta Kappa.

He received his degree of Doctor of Medicine from Columbia in 1885. He then served as House Surgeon at the Roosevelt Hospital from 1886 to 1887, and studied in Vienna and elsewhere abroad the following year. From 1888 to 1981 he practiced in New York City, being connected with the Roosevelt Hospital and the Vanderbilt Clinic. From 1891 until his retirement about three yaers ago, he practiced in Salt Lake City, specializing in dermatology. He was Visiting and finally Consulting Physician to St. Marks Hospital, and was a member of the Salt Lake City Board of Health. He was prominent in church affairs, being affiliated with the Presbyterian Church, and served in many social and public organizations identified with the interests of Salt Lake City. He was a fellow of the American Medical Association, the Salt Lake County Medical Association, and the Academy of Medicine.

Dr. Silver was married in 1901 to Miss Bessie Larson of Salt Lake City. He was a twin brother of Dr. Lewis M. Silver, and a cousin of Herbert B. Wilsox.

Dr. Silver was a man of high repute both in and out of the profession, and throughout his entire life devoted himself most conscientiously to the welfare of his profession and his patients. He enjoyed a large and responsible practice, and was continuously identified with the best social and political life of his environment.

(Furnished by Dr. Harlow Brooks, F.A.C.P., Governor for eastern New York.)

Dr. James D. Love (Fellow), Jacksonville, Florida, died March 26, 1930, of pneumonia; aged 57.

Dr. Love was born in Quincy, Florida, attended local and private schools in early life, graduated at the West Florida Seminary at Tallahassee with the degree of A.B., and in 1897 received his degree of Doctor of Medicine, as the honor man of his class, from the University of Maryland, Baltimore. He served one year internship in the obstetrical department of the University Hospital, and then located in Jacksonville, June 6, 1898, as a general practitioner. In 1909, he decided to devote his practice to pediatrics, and went to Vienna, Paris, London and Boston to prepare himself for this specialty. He did postgraduate study in Boston and New York during 1910 and 1911, and later in St. Louis. In 1913 and 1914, he began confining his activities to the diseases of children.

Dr. Love was a member of the Duval County Medical Society, Florida Medical Association, Southern Medical Association, and had been a Fellow of the American College of Physicians since 1920. He had served as the Governor for Florida in the latter organization almost since the beginning of his membership. He was a member of the teaching staff of the Southern Pediatric Seminar, Saluda, N.C., a member of St. Luke's hospital staff since its organization, Consulting Pediatrician to the Duval County Hospital, Physician-in-Chief of Staff of

the Florida Children's Home, and a member of the staff of Riverside Hospital, Jacksonville. He had been President of the Duval Medical Society for two years, President of the Florida Medical Association, Secretary, Vice-Chairman and Chairman of the Pediatric Section in the Southern Medical Association. At the time of his death, he was alternate representative of the Florida Medical Association to the House of Delegates of the American Medical Association.

His contributions to medicine were many; he commanded the respect and the attentive hearing of every one at scientific meetings.

"His life was gentle and the elements
were so blended in him
That all Nature might stand up, and
say 'There was a Man!'"

(Furnished by Dr. R. H. McGinnis, F.A.C.P., Jacksonville.)

Dr. John Garnett Nelson (Associate), Richmond, Virginia, died, March 30, of abdominal carcinoma; aged 58 years. Dr. Nelson was elected to full Fellowship in the College on October 27, 1929, but due to his illness was never able to attend the Convocation and take up his Fellowship.

Dr. Nelson received his medical degree from the University College of Medicine in 1900, and at the time of his death was Professor of Clinical Medicine of the Medical College of Virginia. He was a prominent physician in Richmond for many years, and was well-known for his activities in connection with the Richmond Tuberculosis Association and as a leader of the McGuire Hospital unit during the World War. He was a member of the Richmond Academy of Medicine, a member of the Medical Society of Virginia, and a Fellow of the American Medical Association. The Medical College of Virginia, as a tribute of respect, suspended afternoon classes on the day of Dr. Nelson's funeral, in order that the faculty and students might attend.